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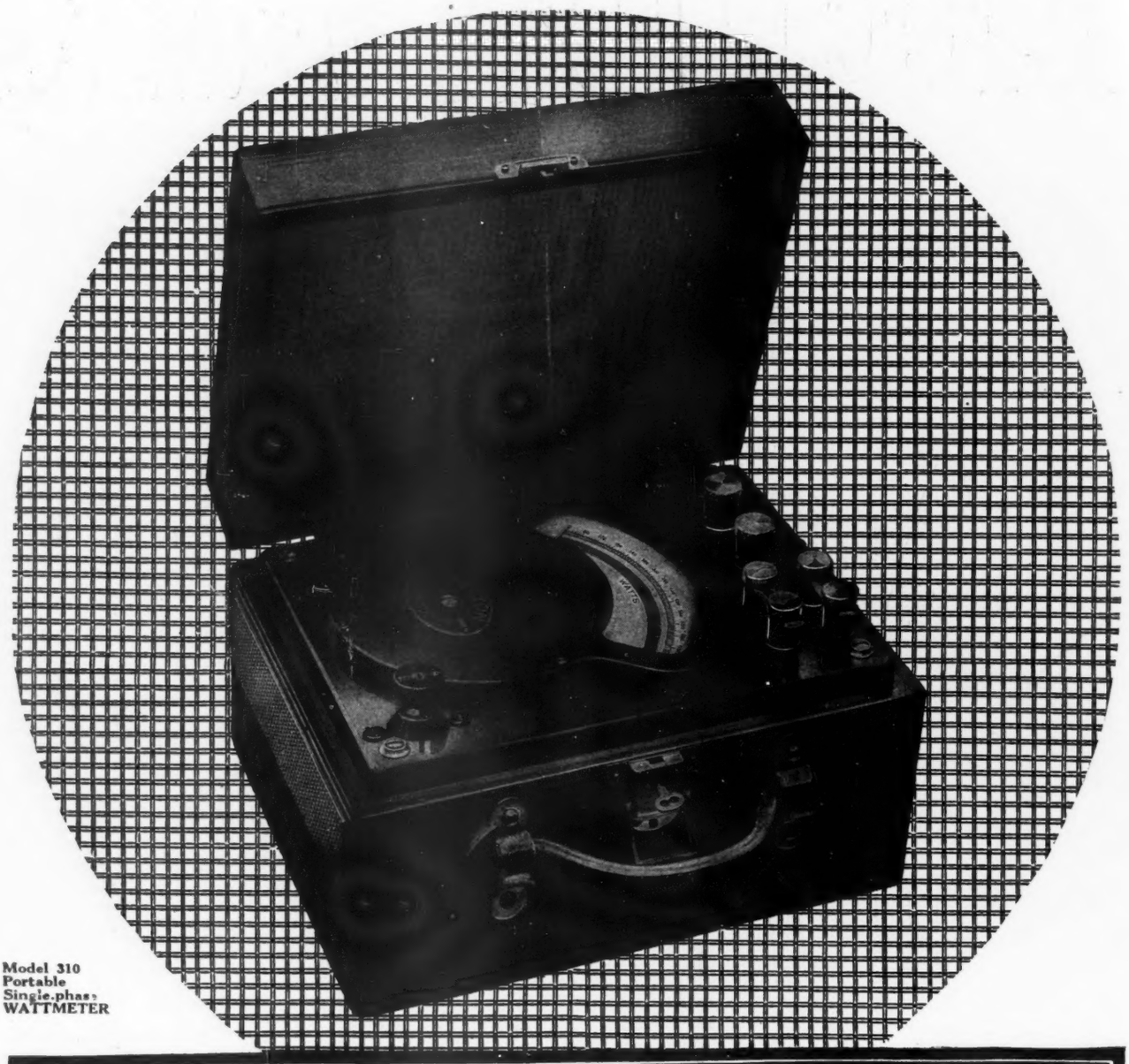

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Holding the New Electrical Markets

EVEN though the credit policy of some American firms supplying foreign needs has become a little more liberal through the establishment of better American banking facilities in other countries, one of the most vital problems in holding our export trade will not be solved until a satisfactory credit practice is established. Representatives of foreign buyers not infrequently say that a return to the highly competitive conditions that existed in foreign markets before the war would be welcome because it would force those who persist in maintaining "cash against document" systems of payment to be more reasonable in their foreign trading policy—as far-away buyers view it—or be content to see the business gained during the war go to other nations. The demand for American electrical products, the familiarity with them and with American installation methods gained because the war shut off other sources of supply, mean much to the American manufacturers who have devoted special attention to export business. The need for the expanded foreign outlet is real, but it is no more real than will be the return of destructive competition unless a uniform trading policy is established and made known without loss of time throughout all countries, and especially among our Latin-American neighbors.

It is a peculiar mixture of government and company management of telegraph and telephone lines which the Postmaster-General has contrived to inflict for the present exigency. Service is the first principle in utility management, but the post office authorities do not appear to appreciate this important fact.

Everybody Works for the N. E. L. A.

MEMBERS of the National Electric Light Association are undoubtedly looking forward with keen interest to a more active year in committee and section affairs than was possible under the conditions of war. They find that already the president-elect has taken definite steps to restore the pre-war activities and start new lines of action. In last week's issue of the ELECTRICAL WORLD a plan of organization was given under which the vice-presidents will have fixed responsibilities. This will mean that they will supplement the executive usefulness of the president. Mr. Ballard is fortunate in the election of four vice-presidents who will join with him in an effort to make the association of much practical value to its members in the coming year.

As the first president from the Pacific Coast Mr. Ballard has a unique opportunity not only of rendering a personal service to the association but also of bringing together more closely the sympathies of the members who are so widely scattered on the map. That he fully appreciates the opening presented to him in this direction is shown by his views printed in the interview elsewhere in this issue. Naturally he has the viewpoint of the great Pacific Coast Section, which in its way is both north and south. It is different from the busy industrial East, different in character and extent of industries, different in proportion of hydroelectric power and long transmission with interconnection, but basically it has the same problems which the East faces. We do not know of any better method by which the association can get into close contact with its country-wide issues than for it to have as careful geographical distribution as possible in the selection of presidents. This is as true of the South and of the great stretches of Central Western area as it is of the highly developed centers of the East. The East is the financial center, it has a large industrial load, but the other sections of the country are just as vitally concerned, and they have a large influence in the settlement of national issues.

Mr. Ballard lays stress upon the importance of letting the public know that the companies are organized as a part of the nation's industry, not a part of its political life. He sees the economic saving in private ownership and operation and, on the part of the companies, the first obligation to give the service that the public wants. Conservation, utilization of water power, settlement of labor questions within the industry and the provision of the enormous sums of capital which are required to meet the needs for expansion are discussed with a thorough comprehension of the nation-wide importance of these subjects. For the association Mr. Ballard recommends national geographic organization without any abandonment of the many state associations which have proved their worth. He also urges development of the company sections and, in considering the association as a whole, a policy of "Everybody works." We feel that the association is making an excellent beginning for its post-war activities and that its field for indispensable service to the industry is a large and promising one.

July 4, 1919, *will be celebrated by America in peace, victory and prosperity. With the greatest war in history terminated by American arms, the one hundred and forty-third anniversary of the nation's independence is surely an occasion too rich in spiritual meaning to be celebrated by mere noise and fireworks. July Fourth this year will be a day of patriotic meetings, of welcome-home ceremonies to returning troops, and—appropriate to the dignity of the day—there comes the opportunity for the electrical men to provide beautiful and striking electrical illuminations to replace noise and fireworks.*

From the Old to the New

THE electric equipment of textile mills was one of the early applications of electric power transmission, dating back a quarter of a century, but it made haste rather slowly, since textile mill operators have learned by experience to be cautious and the full advantages of electric drive appeared only after considerable experimentation on the part of the bolder spirits in the business. In fact, it turned out that the application of electricity to textile machinery was most fertile in valuable results, and mill after mill has fallen into line, until at the present time one may speak of electrical driving as the typical modern equipment. One of the striking examples of such progress is described in this issue, the particular mill concerned, at Cohoes, N. Y., being equipped with more than 5000 looms and 200,000 spindles.

This mill started more than eighty years ago, operated by water power, according to the custom of the times. The old motive-power equipment with comparatively small modifications held its place until 1911, when improved waterwheels were added, two of them coupled to electric generators, and a steam electric auxiliary was added to help in times of low water. Another change was impending, for the Cohoes Power Company four years later installed a 30,000-kw. hydroelectric plant and the waterwheels were then abandoned and the whole equipment run from purchased power. At this time the drive was overhauled. Power was cheap, shafting and pulleys dear, so the group drive which had previously been used was retained with slight modification, employing motors around 100 hp. in size, rated for heavy duty so that the power factor might be well maintained. In point of fact it reached 86 per cent, an admirable figure for induction motor drives. The motors were mostly mounted on the ceiling close to posts or walls, where they would be well supported, and the motor starters were mounted on adjacent walls. The principal difficulties were with the starters, but a little instruction of the operators helped to relieve the situation. The motors themselves have given very little trouble. An occasional burned-out bearing and some annoyance from lint and dirt were the chief faults which developed. It is worth noting that while the motors at the start were of the semi-inclosed type, it was found that they caught more lint than when open, and therefore the shields were taken out and kept out. The article referred to contains valuable details as to the maintenance system and equipment which engineers on similar work will appreciate. Many tests of power taken are also recorded. These show an excellent design and good upkeep of the drive. The warp spinning ran a little over fifty spindles per horsepower, the filling spinning in the neighborhood of seventy-five, while the looms averaged about ⅓ hp. apiece, the looms being of two kinds, 32-in. (81.2-cm.) at 180 picks per minute and 40-in. (101.6-cm.) at 160. The data certainly indicate well-planned drives and extremely well-maintained equipment,

It is particularly interesting to see an old waterpower mill passing first to electric drive in part and then taking the long further step of using transmitted power alone. One by one the old groups of mills which used to cluster about water powers have turned away from the older practice until now there is small need for considering anything except an electric drive.

The time has come to install electric wiring and appliances on the basis of quality and not price. With the new level of prices in every other line, the public is to-day ready to command and pay for service, rather than for cheapness. If electrical men will show the public the advantages of oversized wiring, plenty of flush receptacles, switches, lighting outlets and electrical devices for the home, we shall be able to raise the whole standard of electrical wiring and equipment entering into the average dwelling—and incidentally to stabilize the smaller contractor-dealers on a new basis of business prosperity and professional service.

A New Service of the "Electrical World"

DURING the war industrial activities in many lines have undergone a growth which would have taken several times the period under normal conditions. From all indications most such plants will never fall back to a pre-war status because American industrial managements have been awakened to their possibilities. However, many of the industries which made enviable wartime profits were carried along by the tide and will now have to consider improved practices and economies of operation if they expect to survive present high labor costs and the competition of plants operating at high efficiency. Before it was a case of turn away orders; now it is match price against price and quality against quality. While many of the industrial plants depended upon electric motors, electric furnaces, etc., during the war, it is quite likely that many adopted the use of such electrical equipment not only because they considered the economy, flexibility of control and other numerous advantages, but because it was easy to secure electric service and apply the power to industrial processes. Now, careful thought must be given to the other advantages if production problems are to be worked out on a maximum economy basis. This the larger plants can do more easily than the small ones because many of them are equipped with the necessary engineering personnel, whereas the small plants generally have to rely on their electrical superintendents or master mechanics who have many other duties to perform. Of course, such companies can still fall back on consulting engineers when they have any problems which their own organization cannot solve, but for many of the every-day tasks they will have to depend on their own men.

To be of service to these men the ELECTRICAL WORLD has established a new section which will be devoted entirely to industrial electrical problems and will supplement the articles of this nature that have been a regular feature of the paper. In this section will be presented the latest ideas on utilizing, installing, repairing and testing all electrical equipment employed in industrial plants. As before, the leading articles will be devoted to the more technical problems of selecting and laying out the electrical equipment required, methods of operating and controlling it, systems of inspecting and maintaining the apparatus so that maximum reliability, economy and production will be secured with the minimum maintenance expense. Besides, the ELECTRICAL WORLD will aim to serve as a clearing house for the exchange of ideas regarding industrial engineering and operating problems and in a liberal way assist readers to solve their industrial electrical problems.

What the War Has Taught the Middle West

PERHAPS the great plants of the Middle West have spent less during the war in general extension work than has been necessary in other portions of the country, but they have attended strictly to business when it comes to questions of efficient operation. The coal difficulty was somewhat less strenuous than in the East, but it was quite bad enough. Prices were high in spite of comparatively short hauls, and an even more serious matter was the difficulty of transportation entailed by the great march of material to the seaboard. To meet this difficulty there has been throughout the Middle West a marked tendency to develop coal storage to an extent hitherto unknown. Plant after plant has equipped big coal-storage yards or developed use of natural gas in connection with coal firing, in one case even going to the length of developing gas fields convenient to the plant. Hydroelectric powers too were sought out for additional supply, or developed as auxiliaries, with a noteworthy tendency toward the working up of small hydraulic privileges available but hitherto unused. The Middle West as a whole is not a country of large water powers, but every 100 hp. or 1000 hp. that can be brought into service at a reasonable rate is just so much insurance against the inroads of the coal bill, already formidable and likely to be more so.

Improved methods of handling fuel, including a revival of the interest in powdered coal, have been a feature of the situation, and many a company has developed its plant in the direction of economizers and improved stokers. This, with added attention to boiler capacity and working with the available plant nearer the limit of its capacity, has worked well in many a difficult situation brought about by rapidly increasing load. In the same direction of increased efficiency is the trend of turbine practice toward larger units of materially increased efficiency. In this territory, as in the East, there have been isolated cases of considerably decreased output at the close of hostilities, but on the whole the load holds up much better than a cautious prophet would have admitted. Through the Middle West as elsewhere there is a steady development of transmission service and interconnection of the smaller plants to the great networks, a tendency long dominant in the region around Chicago.

With this tendency has also come increasing use of outdoor substations as an element in plant economy. In fact, the time has come when the engineer who proposes to put up an expensive substation building to house simple transmission apparatus is on the defensive and is liable to be called down as an old fogy. Transmission-line practice has undergone some interesting changes. Many small communities are now being served where cost of construction is of vital importance. In such cases it is notable that the tendency has gone even with wooden-pole lines to spans of 200 ft. (60 m.) or more, a practice often recommended in these columns. It is high time to break away from the old precedents of telephone and telegraph practice, and the change is stimulated by the increasing cost of poles. The mid-voltages, too, are passing out of their one-time popularity, perhaps owing to the sanctifying influence of the suspension insulator, so that the tendency in pressure is toward 50,000 volts to 70,000 volts when anything more than 10,000 to 15,000 would seem to be desirable. There is also a tendency toward the standardization of voltages in order to get rid once and for all of the great variety which have remained as a monument to the cautious and tentative evolution of high-tension transmission.

In distribution matters some growing improvements are worthy of note, in particular the freer banking of transformers and interconnection of secondaries, long known to be advisable and now encouraged by the stress of added needs for output. Another tendency which is worth recording has to do with the periodicity, which shows inclination toward standardization at 60 cycles, in spite of the arguments adduced by the advocates of 25 cycles. This controversy is more or less a relic of old times, when engineers stood in wholesome awe of inductance and capacity difficulties and electrical manufacturers fought shy of induction motors of extreme multipolar design. Finally the farm power business through the great fertile country of the Middle West has come to life again, with a strong probability that the growth of demand after the war is to produce a more complete distribution of energy to the people than has ever yet been approached.

The new activity in state associations of central-station companies is an encouraging sign of the return to normal conditions. There is no longer any desire for the curtailment of such activities and the associations are too valuable to their members to be allowed to lapse into inactivity. The contact with local problems which they afforded in pre-war days will now once more prove its great benefit to the constituent companies.

Electric Brass Melting Is Economical

OFFHAND one would be tempted to say that the complex transformation of energy from fuel to electricity and back again to heat, as required for electric furnace operation, would involve such economic disadvantages that it could not be considered as a commercial proposition. However, brass furnaces, even more than steel furnaces, are showing their economic value in permitting better quality of product, minimizing metal loss and reducing amount of labor.

Furthermore, the temperature is under precise control and the furnace atmosphere is free from contaminating gases and may be made reducing, neutral or oxidizing. These are particularly important points in the melting of non-ferrous alloys because on them depend the metal loss and quality of the product. The gas absorption is materially less than in fuel-fired furnaces, so that more homogeneous metal exceptionally free from blowholes can be obtained. The actual cost of melting brass per ton is considerably less with the electric furnace and energy at 1.5 cents per kilowatt-hour than with gas, coal or coke furnaces at the present prices of fuel.

What is true of brass is to a certain extent true of many other alloys, especially those in which there is considerable difference in the melting and volatilization temperatures of the constituents. In not a few cases the ability to work in neutral or reducing atmosphere is vital to the successful production of alloys. The experience in the metallurgy of brass which has been well recounted by E. J. Collins in the May 24 issue of the ELECTRICAL WORLD may well be taken to heart by all those who have to deal with metallurgical processes.

East and West Meet in the N. E. L. A.

President-Elect Ballard Discusses Some of the Problems of the Industry and the Pacific Coast Attitude Toward Various Important Issues of a National Character

R. H. BALLARD brings a typical Western point of view to the presidency of the National Electric Light Association. Lest this should be thought alarming by those conservative Easterners who have never traveled beyond the west bank of the Hudson River, it may be said that he sees no reason why the East and West should not coöperate in a big way on matters electrical. He sees every reason why they should do so.

"The Pacific Coast," says Mr. Ballard, "has no desire to secede from either the Union or the N. E. L. A."

Two weeks were spent by the new president in the East after the Atlantic City convention before he went to his home in Los Angeles. Most of this time was passed at association headquarters in New York, where there were meetings with the vice-presidents and conferences with a number of others interested. There were also trips to Washington and Boston, and, on the way West, stops at Cleveland and Chicago. The president-elect left New York feeling that the association work is well organized for the coming year and that good results are to be anticipated from the plans made.

PRESIDENT-ELECT BALLARD

Mr. Ballard, whose title outside of association work is first vice-president and assistant general manager of the Southern California Edison Company, Los Angeles, has as his slogan "Everybody works."

As stated in last week's issue of the ELECTRICAL WORLD, the four vice-presidents of the association—Martin J. Insull, Milan R. Bump, Frank W. Smith and Walter H. Johnson—will take an active part in the work during the coming year.

The new executive of the N. E. L. A. was asked by a representative of the ELECTRICAL WORLD to explain something of the California point of view about which New York has heard so much and to discuss in detail some of his ideas on questions affecting the industry and the association. He replied that he was particularly glad to do so because he regarded his election as a compliment to the Pacific Coast.

"As the Pacific Coast has never before had a president of the N. E. L. A.", he added, "I feel confident in saying that the companies in that section will be pleased and will take hold with new energy of the work that they can do in common with national headquarters. There are national problems which touch the entire industry just as there are localized problems which have to be met locally."

Mr. Ballard feels very strongly that the N. E. L. A. has a great task before it in letting the public know just what it is and just what the companies in its membership are. The companies are public service corporations, that is to say, public servants, and they must give satisfactory service at every point of contact with the public. The companies' greatest asset consists of contented consumers, a satisfied public.

"We are not organized for political purposes," he declared. "We are a part of the nation's industry, not a part of its political life. We want to be known to the public as an industry. We want to have the public understand that we are in business as private companies engaged in furnishing an industrial service. We would like to have the public know the men who are operating the properties, know their methods, appreciate how they are trying to render a service.

"We feel that the advantages of private ownership of these utilities are very clear. They are seen by us and we should try to make them just as plain to the public. We know that private ownership can build these properties and operate them for less than public ownership. We know that private ownership can give better service at lower rates than public ownership. In fact, we know this so well that we are inclined to take it for granted that everybody has just as keen a realization of it as ourselves. It is necessary that we shall relieve ourselves of over-complacency on this subject. We cannot well expect the public to know without being told, and we cannot expect the public to be easily satisfied with a mere statement of the fact. We must be prepared to prove that the statement is true. Prove that it is true by demonstrating our ability to give thoroughly satisfactory service. Works speaks louder than words."

The president-elect was asked about the expression "Service before profit," which has come across the continent from California. He said that the principle which has been developed in California is that the utilities must put the question of service first. Their first obligation is to give the service that the public wants. If service is given, the regulating commission will see that an adequate return on capital is allowed.

On being asked what he regarded as an adequate return, the Californian said that the rate must be such as will attract capital for the development of the business. In order to provide the necessary reserve for safety required by the investor who purchases the securities there should be a reasonable margin over the cost to the company of securing funds. With this policy assured, money will flow to the utilities in the

needed amounts; without it the money will not be forthcoming. Mr. Ballard also emphasized the announcement of President Wilson last year, together with the similar statements by Secretary of the Treasury McAdoo and Comptroller of the Currency Williams, that it is essential that the utilities be kept in sound financial condition to maintain maximum efficiency.

"We are not yet out of the woods," he continued, "and the conditions which led the President to issue his appeal to the regulating commissions still exist, though modified by reductions of operating cost in some directions."

President-elect Ballard then went into the subject of national organization of the industry. Speaking for himself and the new administration generally, he said that the motto would be "Everybody works."

"We want to make our organization effective in meeting every question that arises during the year touching the national issues," he stated. "There is every reason in the world why the industry of the entire country should pull together for unity of action. It is the best policy. The full effective force of the whole industry can be unified to advance the industry and to study the large questions affecting its welfare."

The discussion then turned to the subject of a more effective organization of geographic and company sections, with the general object of relieving national headquarters and the national annual convention of much detail.

"The purpose would be," Mr. Ballard said, "to keep the discussion of purely local matters in the community or state or states more directly concerned. Thus the national association and the national convention would be left free to handle on a large scale the big questions involving the whole industry. I believe that more of the detail work should be done in the geographic sections. It would be extremely desirable for the whole country to be organized into geographic sections. I should like to say emphatically that the formation of geographic sections would not mean the abandonment of the state organizations wherever those are thought necessary by the companies. It would involve simply the organization of state associations into geographic sections which would be affiliated with the parent body. The importance of state organization cannot be minimized."

Mr. Ballard is anxious that the companies shall develop the activities of the company sections successfully during the coming year. "This is both for the sake of unity in the company and for the development of men," he declared. "There should be a line of progress from company section to state and geographic section and national association."

As may be judged by his slogan "Everybody works," the president-elect is a firm believer in earnest coöperation. He believes that all branches of the industry should be brought together and that there is no room for any serious difference of opinion between manufacturer, jobber, central station and contractor-dealer. The California coöperative campaign, fostered by all the branches, has done notable work.

Some of the problems of the industry were discussed at the request of the ELECTRICAL WORLD representative.

In speaking of state regulation Mr. Ballard called attention to the fact that the various commissions are not uniform in their treatment of various subjects, such as methods of valuation and the principles upon which rate of return is fixed, etc. He is of the opinion that the maintenance of the commissions, with their broad powers of regulation, will promote the needed thorough understanding between the companies and the public.

The question of labor and of the participation of employees in the earnings of the company is also a large subject which should receive attention.

Another matter which Mr. Ballard believes should have the consideration of all companies is that of conservation of resources.

"We can take advantage of what the war has taught us as to the value of power resources," he said. "We can go into the factories and teach people not to waste coal and power. This question receives added importance from the fact that sooner or later we shall face railroad electrification on a nation-wide scale with the immense requirements for power which that will bring. An essential feature in the program of conservation is utilization of our full measure of water power. This is true conservation, and we cannot put the case too strongly in urging a policy that shall utilize our resourses without waste."

The president-elect also indicated the seriousness of the problem of raising capital in the huge amounts needed for development.

"I know that this is a big problem confronting us in the West," he said, "and I assume that it is about the same in the East. But with the companies committed to the policy of giving service first and letting the public know that they are here to serve and with a thorough understanding by the public and the commissions that fair earnings on capital are requisite for development, I feel that the capital requirements will be met."

I HAVE heard men say that America can sell and is selling quantities of goods abroad without the use of the metric system. Certainly she is. She can do that to a certain extent, but compared to what America could do if she would adapt herself to the needs of the people abroad, it is like selling cheap remnants. The day when any nation engaged in industrial production could impose its ideas and views on any nation to which it desired to sell goods has gone by, if it ever existed, and the only way you can sell goods in these days is to sell to the people exactly what they want. A company must sell its mechanical goods of all kinds in the markets of the world, made in the way the people want them, and no amount of explanation on the part of salesmen will make the United States standard wrench go on a hardened nut finished on the metric system, and it is nonsense for any one to suggest anything to the contrary. It won't fit, and you cannot sell any more goods of that kind. For men to go to a French factory and to attempt to sell for use in that factory an engine constructed on the feet and inches basis would be so hopelessly ridiculous that only a man entirely lacking in judgment would ever do it.—*Secretary of Commerce Redfield.*

Calculating Induction-Motor Magnetizing Current

An Equation Connecting Magnetomotive Force and Effective Magnetizing Current Is First Derived—Magnetizing Currents for Polyphase Induction Motors Are Then Calculated from the Relation Between Counter Emf., Flux and Magnetomotive Force

BY C. M. LAFFOON
Electrical Engineer, Engineering Department Westinghouse Electric & Manufacturing Company

THE no-load or exciting current of a polyphase induction motor can be resolved into two components—an energy component in phase with the voltage and a wattless or magnetizing component at quadrature with the voltage. The energy component supplies the power required for the no-load primary and secondary losses and can be determined from the measured or calculated value of the no-load input to the motor. The magnetizing effect of the energy components of the exciting currents can be neglected, for it is approximately neutralized by the opposing magnetizing action of the no-load secondary currents. The wattless or magnetizing currents flowing through the respective phases of the primary winding produce the rotating magnetic field which induces the counter electromotive force in the primary winding and the secondary electromotive force in the secondary windings.

TABLE I—VALUE OF C_p FOR $\theta = 30$ DEG.

Angle θ	Amperes in Phase A	Amperes in Phase B	Amperes in Phase C	Maximum Height of Mmf. Diagram	Area of Mmf. Diagram
0	0	0.866	0.866	13.856	221.696
10	0.1736	0.9369	0.766	15.012	222.508
20	0.342	0.9848	0.6428	15.756	223.86
30	0.5	1.00	0.5	16.00	224.0
40	0.6428	0.9848	0.342	15.756	223.86
50	0.766	0.9369	0.1736	15.012	222.508
60	0.866	0.866	0	13.856	221.696
Average					222.61112

The relation between effective magnetizing current and magnetomotive force for induction-motor windings will first be established. Then, since the numerical value of the counter electromotive force induced in the primary winding can be closely approximated, the actual value of the magnetizing current can be determined from the fundamental relations connecting the counter-electromotive-force, rotating-flux and rotating-magnetomotive-force diagrams.

THREE-PHASE INDUCTION MOTORS

The actual rotating-magnetomotive-force diagram, which is produced by the magnetizing current flowing through the primary winding of a three-phase induction motor, varies in shape, area and maximum height for different angular positions of the rotor of the alternator supplying current to the motor. If the magnetizing current varies according to a sine law with respect to time as shown in Fig. 1, the actual magnetomotive-force diagrams can be determined and plotted. The magnetomotive-force diagrams shown in Figs. 3 to 9 are for a three-phase induction motor having eight slots per phase per pole and a full-pitch winding. These diagrams are plotted for the current relations at regular ten electrical degree intervals over a range of sixty electrical degrees, or one complete diagram cycle. It is obvious from Fig. 2 that in the case of a balanced full-pitch, three-phase winding the maximum height of the magnetomotive-force diagram is proportional to the maximum resultant ampere turns per pole.

The values of the area and the maximum height of the magnetomotive-force diagrams of Fig. 3 to 9 for different angular positions of the current vectors are shown in Table I.

By plotting the values of area and maximum height of the magnetomotive-force diagram against the angular position of the alternator armature, as shown in Fig. 10, it is shown that the maximum area and height of the diagrams occur when ϕ is 30 degrees; that is, when the currents in phase A and C are proportional to $\frac{1}{2}$ and the current in phase B is proportional to 1.

The actual value of the maximum ampere turns can be determined analytically as follows:

Let W = total number of effective wires on the stator; $W/3$ = total number of effective wires on the stator per phase; $W/3p$ = total number of effective wires on the stator per phase per pole, and $A \sin \theta$ = instantaneous current in phase A; $A \sin (\theta + 60)$ = instantaneous current in phase B; $A \sin (\theta + 120)$ = instantaneous current in phase C; where A is the maximum value of the current per phase.

Then,

$(\frac{1}{2}AW/3p) \sin \theta$ = maximum instantaneous ampere-*turns* per pole due to phase A.

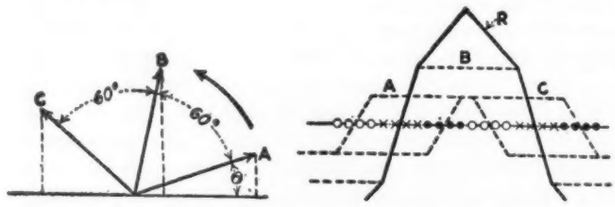
$(\frac{1}{2}AW/3p) \sin (\theta + 60)$ = maximum instantaneous ampere-turns per pole due to phase B.

$(\frac{1}{2}AW/3p) \sin (\theta + 120)$ = maximum instantaneous ampere-turns per pole due to phase C.

And

$$(\tfrac{1}{2}AW/3p)\,(\sin\theta + \sin(\theta + 60) + \sin(\theta + 120)) = (AW/3p)\sin(\theta + 60),$$

which is the maximum instantaneous resultant ampere-turns per pole due to all phases. (1)



FIGS. 1 AND 2—VECTOR REPRESENTATION OF MAGNETIZING CURRENTS AND MAGNETOMOTIVE-FORCE DIAGRAM

Thus the maximum value of the maximum ampere-turns per pole occurs when $\theta = 30$ degrees and is

$$h_{max} = AW/3p \quad (2)$$

The maximum area of the magnetomotive-force diagram which also occurs when $\theta = 30$ deg. can be determined in terms of the maximum ampere-turns as follows:

Let

H_{max} = area of the magnetomotive-force diagram when $\theta = 30$ deg.

b = length of the base of the magnetomotive force diagram.

c_p = ratio of the average height of the diagram to the maximum height.

h_{max} = maximum height of the magnetomotive force diagram when $\theta = 30$ degrees $= AW/3p$.

$$H_{max} = h_{max} \times b \times c_p = (AW/3p) \times b \times c_p \quad (3)$$

The value of c_p can be determined from the conditions of the magnetomotive-force diagram shown in Fig. 5, which are given in Table I for $\theta = 30$ deg.

From Fig. 5 and the data in Table I these conditions are found to be,

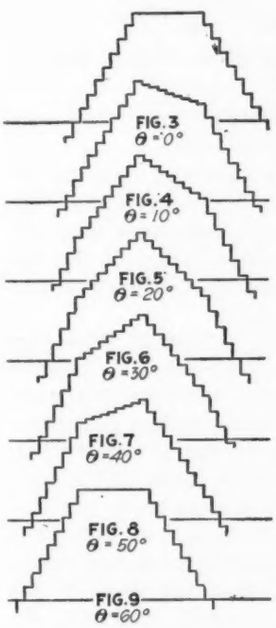
$$H_{max} = 224,\ \tfrac{1}{3}AW/p = 16, \text{ and } b = 24.$$

Substituting these values in equation (3) and solving for c_p gives:

$$c_p = 224 \div (16 \times 24) = 7/12 = 0.583.$$

Hence the general expression for the area of the magnetomotive-force diagram for the current conditions, which give the diagram with maximum area and height, is

$$H_{max} = \tfrac{1}{3} \times 0.583 \times (AW/p) \times b \quad (4)$$



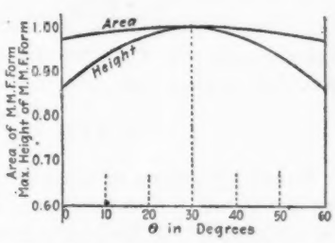


FIG. 10—AREA AND MAXIMUM MMF. FOR THREE-PHASE MOTOR

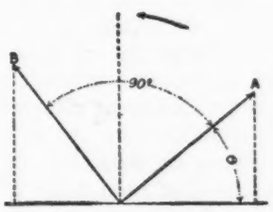


FIG. 11—VECTOR DIAGRAM FOR MAGNETIZING CURRENTS OF TWO-PHASE MOTOR

FIGS. 3 TO 9—MMF. DIAGRAMS FOR A THREE-PHASE INDUCTION MOTOR

From the data in Table I it can be shown that the average area of the magnetomotive-force diagrams for all angular positions of the current vectors is 99.38 per cent of the maximum area, or

$$H_{ave} = 0.9938\ H_{max} = 0.9938 \times \tfrac{1}{3} \times 0.583 \times (AW/p) \times b \quad (5)$$

USE OF EQUIVALENT HARMONIC MMF.

In order to get a more useful diagram from the standpoint of making design calculations, the actual varying magnetomotive-force diagram shown in Figs. 3 to 9 can be replaced approximately by uniform sine-shaped magnetomotive-force diagrams having the same area as the average area of the actual magnetomotive-force diagrams and rotating at uniform speed.

If

h = maximum height of the equivalent sine-shaped magnetomotive-force diagram,

b = width of the base of the equivalent sine-shaped magnetomotive-force diagram;

then the area of the equivalent sine-shaped magnetomotive-force diagram is

$$H'_{ave} = 0.636hb = H_{ave} \quad (6)$$

Substituting this value of H_{ave} in equation (5) and solving for the maximum height—that is, the maximum ampere-turns of the equivalent sine-shaped magnetomotive-force diagram—gives

$$h = 0.9938 \times (0.583/0.636) \times \tfrac{1}{3} \times (AW/p) \quad (7)$$

$$= 0.91 \times \tfrac{1}{3} \times (AW/p) \quad (8)$$

for a three-phase induction motor having a balanced full-pitch winding.

In the case of three-phase induction motors with chorded windings the actual magnetomotive-force diagrams can be determined for different percentages of chording as in the case of the full-pitch winding. The summarized magnetomotive-force diagram data for a three-phase induction motor having a balanced winding, for different percentages of chording, is given in Table II.

It is evident from a comparison of the data in columns (3) and (5) of Table II that the ratio of the average area of the magnetomotive-force diagram for a given per cent chording to the average area for a full-pitch winding is equal to the sine of half of the angle of coil throw. That is,

$$(H''_{ave}/H_{ave}) = \sin(\alpha/2) \quad (9)$$

Substituting the value of H_{ave} 0 per cent chording of equation (5) in equation (9) gives

TABLE II—SUMMARIZES MMF. DIAGRAM DATA FOR THREE-PHASE INDUCTION MOTOR WITH BALANCED WINDING

(1)	(2)	(3)	(4)	(5)
Per Cent Chording	$\frac{\alpha}{2}$ = One half Coil Throw	$\sin\frac{\alpha}{2}$	H″ave	$\frac{H''ave}{Have}$
0	90	1.00	222.61	1.00
16⅔	75	0.966	214.3	0.964
25	67.5	0.924	205.9	0.924
33⅓	60	0.866	193.2	0.866

$$H'_{ave} = 0.9938 \times \frac{1}{3} \times 0.583 \times \frac{AW}{p} \times b \sin \times \frac{\alpha}{2} \quad (10)$$

Substituting this value of H''_{ave} in equation (6) and solving for the value of the maximum ordinate of the equivalent sine-shaped magnetomotive-force diagram gives

$$h = AT_{max} = 0.9938 \times \frac{1}{3} \times \frac{0.583}{0.636} \times \frac{AW}{p} \times \sin\frac{\alpha}{2}$$

$$AT_{max} = 0.91 \times \frac{1}{3} \times \frac{AW}{p} \times \sin\frac{\alpha}{2} \quad (11)$$

But $A = \sqrt{2}\,A_e$, where A_e is the effective current per phase, and substituting this value of A in equation (11) gives

$$AT_{max} = 0.91 \times \frac{1}{3} \times \sqrt{2} \times \frac{A\,W}{p} \sin(\alpha/2) \quad (12)$$

From equation (12) the value of the effective current per phase is

$$A_e = \frac{3\sqrt{2}\,p\,AT_{max}}{0.91 \times 2\,W \sin(\alpha/2)}$$

$$A_e = 2.335 \times p \times \frac{AT_{max}}{W \sin(\alpha/2)} \quad (13)$$

TWO-PHASE INDUCTION MOTORS

In the case of a two-phase induction motor with a full-pitch winding the variations in shape, area and maximum height of the magnetomotive-force diagram for different current relations are greater than for a three-phase motor. The actual magnetomotive-force diagrams for a two-phase induction motor with six slots per phase per pole and a full-pitch winding are shown in Figs. 12 to 17.

The values of the area and maximum height of the above diagrams are plotted in Fig. 18 over a range of 90 electrical degrees, or one complete diagram cycle.

The maximum height and the minimum area of the magnetomotive-force diagram occur when $\theta = 45$ deg. Using the same notation as in the previous case, the actual value of the maximum instantaneous ampere-turns of the magnetomotive-force diagram can be determined analytically to be

$$h''_{max} = \sqrt{2}AW/4p \qquad (14)$$

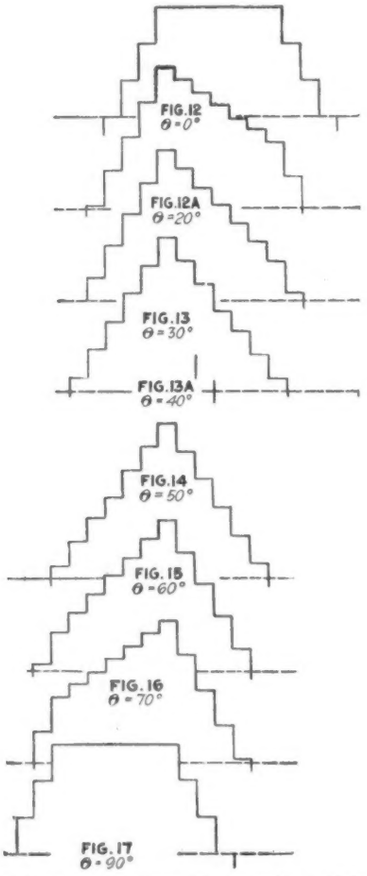
The minimum area of the magnetomotive-force diagrams, which also occurs when $\theta = 45$ deg., can be determined from the conditions in Fig. 17 to be

$$H_{min} = AW\sqrt{2}b/(4 \times 2p) \qquad (15)$$

It can be shown that the average area of the magnetomotive-force diagrams of a two-phase induction motor with a full-pitch winding is 103.36 per cent of the minimum area, or

$$H_{ave} = 1.0336 \times [AW\sqrt{2}b/(4 \times 2p)] \qquad (16)$$

For chorded windings it can also be shown, as in the case of three-phase induction motors, that the average area of the magnetomotive-force diagram is



FIGS. 12 TO 17—MMF. DIAGRAMS FOR A TWO-PHASE INDUCTION MOTOR

$$H''_{ave} = H_{ave} \sin(\alpha/2) = 1.0336 \times \frac{AW\sqrt{2}b}{4 \times 2p} \sin\frac{\alpha}{2} \qquad (17)$$

Substituting the value of H''_{ave} in equation (6) and solving for the maximum ampere turns of the equivalent sine-shaped magnetomotive-force diagram gives

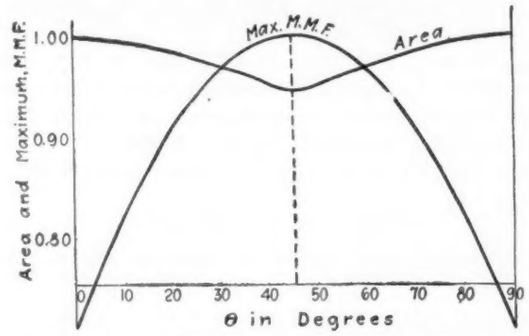


FIG. 18—AREA AND MAXIMUM MMF. DIAGRAMS FOR A TWO-PHASE INDUCTION MOTOR

$$h = AT_{max} = 1.0336 \times \frac{1}{0.636} \times \frac{AW\sqrt{2}}{4 \times 2p} \sin\frac{\alpha}{2} \qquad (18)$$

$$= 1.0336 \times \frac{1}{0.636} \times \frac{A_e W}{4p} \sin\frac{\alpha}{2} \qquad (19)$$

Solving equation (19) for the effective magnetizing current per phase gives.

$$A_e = 2.465 \times \frac{p\,AT_{max}}{W \sin(\alpha/2)} \qquad (20)$$

Hence by means of equations (13) and (20) the effective value of the magnetizing current per phase can be calculated for three-phase and two-phase induction motors, provided that the maximum value of the ampere turns of the equivalent sine-shaped magnetomotive-force diagram can be ascertained.

Since the actual magnetomotive-force diagram has been replaced by an equivalent sine-shaped diagram which rotates at synchronous speed, the induction motor can be treated as an alternator with rotating field poles. It is obvious from the analogy to the alternator that the maximum value of the ampere turns will depend upon the maximum value of the ampere turns required for the air gap, stator and rotor teeth and stator and rotor cores, and also upon the amount of saturation in the stator and rotor teeth, *i.e.*, upon the shape of the rotating field form. Then the value of maximum ampere turns in equations (13) and (20) is

$$AT_{max} = AT_{max\ (g.+t.)} + AT_{max\ (s.c.)} + AT_{max\ (r.c.)} \qquad (21)$$

where

$AT_{max\ (g.+t.)}$ = maximum ampere turns required for air gap, stator and rotor teeth.

$AT_{max\ (s.c.)}$ = maximum ampere turns required for stator core.

$AT_{max\ (r.c.)}$ = maximum ampere turns required for rotor core.

AMPERE TURNS REQUIRED FOR MAGNETIC CIRCUIT

Applying the fundamental voltage formula of an alternator to the induction motor, the counter electromotive force induced in the windings by the rotation of the gap flux at synchronous speed is

$$*E_c = B_{max}SR_e'C_w \sin(\alpha/2)\ 10^{-8} \qquad (22)$$

in which

*Derived by B. G. Lamme, chief engineer Westinghouse company.

S = circumferential section of the air gap in square inches.

R_s = synchronous speed of the rotating field in revolutions per second.

W' = total number of effective wires in series.

B_{max} = maximum flux density in the air gap.

C_w = root-mean-square electromotive force per conductor, expressed as a percentage of the maximum height of the field form.

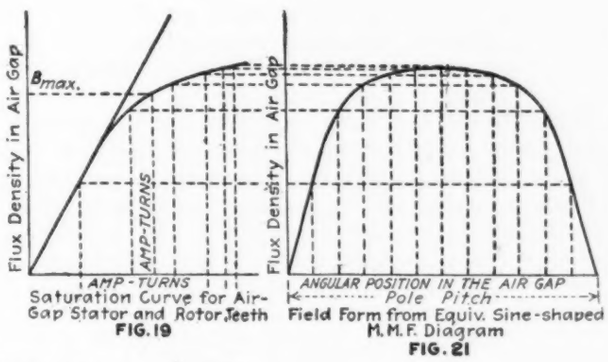
$\sin(\alpha/2)$ = chord factor.

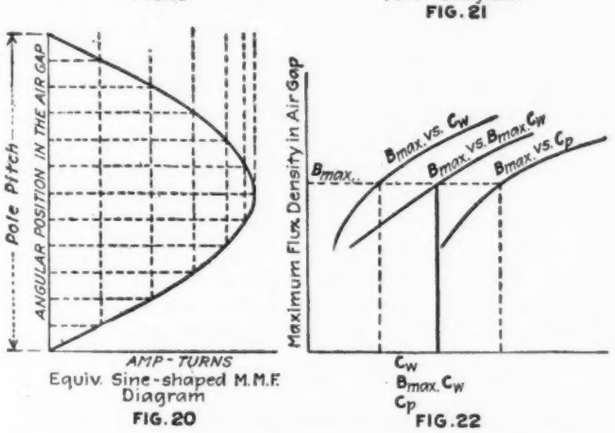
The counter electromotive force induced in the primary is practically constant from no load to full load for a given induction motor. As a first approximation the numerical value of the counter electromotive force can be assumed a given percentage of the impressed electromotive force. The value of $B_{max} \cdot C_w$, which is practically constant for a given motor, can be determined from equation (22).

$$B_{max} \times C_w = \frac{E_c 10^8}{R_s S W' \sin(\alpha/2)} \qquad (23)$$

With the value $B_{max} \cdot C_w$ determined by equation (23), the value of the maximum ampere turns required for the air gap, rotor and stator teeth can be determined as follows:

(a) Calculate and plot a saturation curve for the air gap, rotor and stator teeth, as shown in Fig. 19.





FIGS. 19, 20 AND 21—DERIVATION OF EQUIVALENT HARMONIC MMF. AND FIELD FLUX FORM FROM SATURATION CURVE

FIG. 22—VARIATION OF C_w, B_{max}, C_w AND C_p WITH MAXIMUM AIR-GAP DENSITY

(b) Assume a maximum value of the ampere turns for the equivalent sine-shaped magnetomotive-force diagram and plot as shown in Fig. 20, and

(c) Divide the pole pitch into equal increments and with the corresponding ampere turns determine the actual field form from Fig. 19 and plot as shown in Fig. 21. With the actual field form in Fig. 21, the corresponding values of C_w—*i.e.*, the root mean square per conductor expressed as a percentage of the maximum value of the field form—and C_p—*i.e.*, the ratio of the average height to the maximum height of the field form—can be calculated. Similarly, other values of C_w and C_p can be determined from additional assumed values of maximum ampere turns of the equivalent sine-shaped megnetomotive-force diagrams, and curves can be plotted between the maximum flux density in the air gap, B_{max}, and C_w, C_p and $C_w \times B_{max}$, as shown in Fig. 22. With the value of $B_{max}C_w$ obtained from equation (23), the actual value of the maximum flux density in the air gap can be found from curve (1) in Fig. 22. With this value of B_{max} the corresponding value of maximum ampere turns, $AT_{max\ g.+t.}$ of the equivalent sine-shaped magnetomotive-force diagram for the air gap, stator and rotor teeth can be taken directly from the saturation curve in Fig. 19.

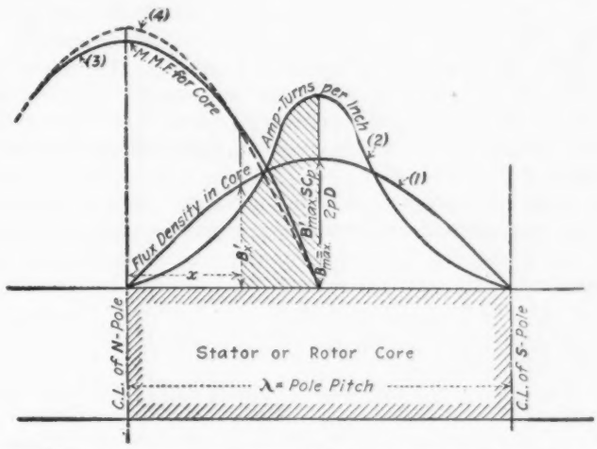


FIG. 23—VARIATION OF EQUIVALENT HARMONIC MMF. FROM ACTUAL VALUES

AMPERE TURNS REQUIRED FOR THE STATOR AND ROTOR CORES

The total flux per pole is

$$\phi_p = B_{max} S C_p / p \qquad (24)$$

where

C_p = ratio of the average height to the maximum height of the field form and can be found from curve (3) in Fig. 22 for the corresponding value of B_{max};

p = number of poles.

If D is the section of the core behind the teeth, the maximum flux density in the core is

$$B_{max} = \phi_p / 2D = B_{max} S C_p / 2pD \qquad (25)$$

The actual flux distribution in the core can be assumed to vary as the integral of the actual field form, but it is sufficiently close for all practical considerations to assume that it varies according to a sine law as shown by curve (1) in Fig. 23. The density at any point distant x from the center line of the pole is

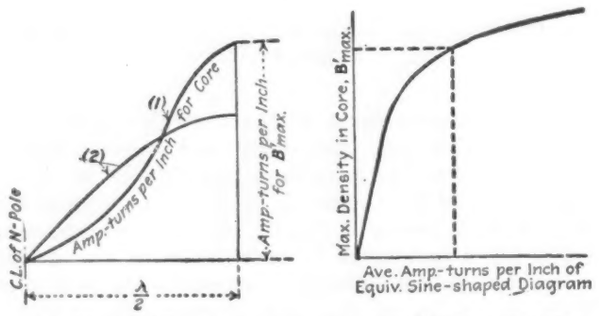
$$B_x = B_{max} \sin x \qquad (26)$$

The ampere-turns-per-inch curve for the core, which is numbered (2) in Fig. 23, can be determined from curve (1) in Fig. 23 and the magnetization curve of the ma-

terial used in the core. It is apparent from these curves that the maximum value of ampere turns of the magnetomotive-force diagram is equal to the area under the ampere-turns-per-inch curve between the limits $x = 0$ to $x = \lambda/2$. The value of the ampere turns on the magnetomotive-force diagram at distance x from the center line of the pole is equal to the area under the ampere-turns-per-inch-curve from $x = x$ to $x = \lambda/2$, as shown in curve (3) of Fig. 23. The equivalent sine-shaped magnetomotive-force diagram having the same area as the actual magnetomotive-force diagram (3) is shown in curve (4) of Fig. 23. However, in actual practice it gives close enough results and greatly simplifies the calculations to take the maximum value of the actual magnetomotive-force diagram equal to maximum value of the equivalent sine-shaped magnetomotive-force diagram.

The determination of the maximum ampere turns of the magnetomotive-force diagram of the cores—*i.e.*, the area under the ampere-turns-per-square-inch curve between the limits $x = o$ and $x = \lambda/2$—can be simplified by substituting for this curve an equivalent sine-shaped curve having the same area as is shown by curve (2) in Fig. 24.

For any given material different values for B_{max} can



FIGS. 24 AND 25—SINE CURVE APPROXIMATING MAXIMUM AMPERE TURNS AND MAXIMUM FLUX DENSITY

be assumed and the average value of the equivalent sine-shaped ampere turns per inch curve can be calculated. The B_{max} can be plotted against this average value of ampere turns per inch as in Fig. 25. Then the average value of the ampere turns per inch for the core can be found from this curve for any value of the maximum flux density B_{max} in the core. The maximum value of the equivalent sine-shaped magnetomotive-force diagram for the stator or rotor core is equal to one-half the pole pitch in inches times the average ampere turns per inch, as

$$AT_{max\ (c)} = (\lambda/2) \times AT_{ave/in.}$$

Hence the values of maximum ampere turns of the equivalent sine-shaped magnetomotive-force diagram for the air gap, rotor and stator teeth and rotor and stator cores can be determined. Substituting these values of ampere-turns in equations (13) and (20) gives the effective value of the magnetizing current per phase

$$A_e = \frac{2.335 \times p \times [AT_{max\ (g.+t.)} + AT_{max\ (s.c.)} + AT_{max\ (r.c.)}]}{W \sin\ (\alpha/2)} \qquad (27)$$

for three-phase induction motors, and

$$A_e = \frac{2.461 \times p \times [AT_{max\ (g.\ \&\ t.)} + AT_{max\ (s.c.)} + AT_{max\ (r.t.)}]}{W \sin\ (\alpha/2)} \qquad (28)$$

for two-phase induction motors.

MEASURING QUANTITIES OF GAS ELECTRICALLY

Problems in Accurate Metering of 100,000 Cu.Ft. per Hour or More of Gas for City Gas Plants, Industrial Plants and Other Users

Not many electric central-station men look on the competing gas company as a possible prospective customer for electric heating service. Nevertheless, they may well do so now that methods of measuring large quantities of gas electrically have been developed and proved on over 100 practical installations. These points were brought out on May 26 by J. C. Wilson, assistant chief engineer Cutler-Hammer Manufacturing Company, Milwaukee, speaking before a joint meeting of the various electrical engineering societies in Chicago.

The meter which is used in this measuring is built to take advantage of the fact that the heat-absorbing capacity of a standard unit of any industrial gas remains essentially the same throughout all the variations which may occur in practice. In other words, a given quantity of heat applied electrically to gas flowing through a main will always raise the temperature of that gas to the same degree if the quantity of gas flowing is not varied. The meter, however, is worked out on the converse of this principle, so that the temperature rise is always 2 deg., and hence it is only necessary to measure the amount of electric current used to cause this temperature rise to arrive at a quantity which is measurable and proportional to the gas flowing.

The apparatus that has been developed to carry out this method consists of the following essential parts: (*a*) a heater through which electric current flows to warm the gas just 2 deg. as it flows through the meter; (*b*) thermometers on the entrance and exit sides of the heater to indicate the rise in temperature; (*c*) a regulator to vary the heater current in accordance with the variations in the rates of gas flow so that it will always be just enough to warm the gas 2 deg., and (*e*) a meter to measure the electrical energy consumption by the heater in warming the gas 2 deg.

The heater unit consists of spiral coils of nichrome resistance wire. Instead of mercurial thermometers electrical resistance thermometers are used because they are extremely sensitive and accurate. Automatic control of the current which must continually heat the gas 2 deg. as it passes is accomplished through the use of a galvanometer connected in the thermometer circuit. This galvanometer actuates a motor-driven rheostat which controls the current. The electrical energy in the heater is measured continuously by a totalizing meter. This is a watt-hour meter of standard construction having a gear-train and dial so arranged that the readings are direct in standard units of gas.

IT COSTS the government more to do any given thing in a country like ours, where every man is a sovereign, than it costs anybody else to do the same thing. The history of every enterprise of a business character conducted by the government proves all and a great deal more than the statement I have just made. I disparage no one and impugn no man's integrity. What I have said is not only the truth, but it is as natural as life itself.—*Senator Cummins, before Iowa State Legislature.*

Rehabilitation of New York Cotton Mill

Starting as Water-Power-Driven Mill in 1837, Harmony Mills Have Grown to Have 5000 Looms and More than 200,000 Spindles, All Motor-Driven—Information Concerning Operating Data and Practices

AT COHOES, N. Y., is one of the largest cotton mills, if not the largest, in New York State, it being equipped with more than 5000 looms and 206,000 spindles. It is known as Harmony Mills. Having been started in 1837 with Cohoes Falls as the source of power and now being equipped with motor-driven apparatus, the development of this mill up to the present time should embody some examples that could be followed to advantage by other cotton mills and industrial plants which are still using the primeval power or which are adhering to steam drive and out-of-date transmissions.

In the original installation power was developed by means of lateral or "step" levels affording heads of about 20 ft. (6 m.) each. Part of the laterals were Erie Canal levels abandoned during the early enlargement in 1838. The first really important rehabilitation took place in 1911, when all of the old mill machinery was junked, the mills were overhauled and new up-to-date machinery was installed with new shafting and drives. At this time four new waterwheels were added to supplement eight old units. Two of the wheels were connected to the mill load directly, while the other two were employed to drive 800-kvá. generators. Means were provided for coupling the wheels or mill shafts when desired. Since there was not enough water at all times to drive the mills, a 3000-kw., 40-cycle, three-phase, 600-volt steam-generating plant was installed to help out during low water, the waterwheel generators

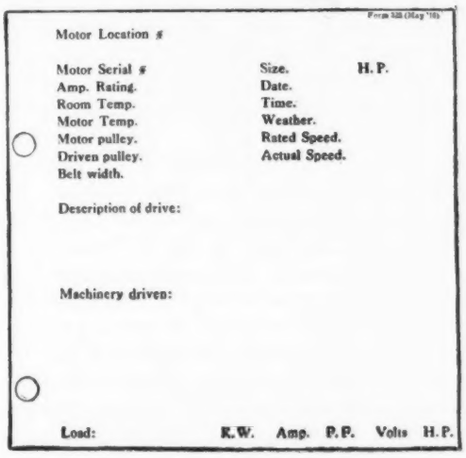


FIG. 1—LOOSE-LEAF RECORD OF MOTOR LOAD

being driven as synchronous motors under such conditions. About 2000 kw. in motors was installed at this time, principally on upper floors.

When the Cohoes Power Company installed a 30,000-kw. hydroelectric plant in 1915 to utilize the power in a 100-ft. (30-m.) head, the mill waterwheels were abandoned and power was purchased from a duplicate 12,000-volt transmission line run from the hydroelectric plant. Three 2000-kw. transformers were provided to step the pressure down to 600 volts for use in the mills, where more motors were provided to supplement those already installed.

Before installing the new motors a consulting engineer was called on the job to run tests on existing motor drives and determine what changes were necessary. Some of the results are tabulated on page 1265.

Owing to the high price of shafting and pulleys and the extremely low cost of power, the existing shafting was used and group-drive motors were placed so that they could drive sections of it. Only in one or two cases

NO. 5 SWITCH			
No.	Hp.	Load	
212	100	354 Looms	118
233	150	40 Filling Frames	152
M1	15	Machine Shop	15
HARMONY COHOES			

FIG. 2—SAMPLE MOTOR IDENTIFICATION CARD

The first number at the left indicates that the motor is in Mill No. 2, on the first floor and the second from the north. The figure at the right indicates the input as measured by test outfit when starting up. The names at the bottom indicate source of power available.

was shafting changed, and then only to split up a drive of one class of machinery so that no more than half of it would be stopped by failure of any one motor. In doing this the drawing and railway heads, which require only a small amount of power, were divided into groups and driven by motors operating other kinds of machinery as well. Care was also taken in connecting loads to the feeders not to make any one process dependent on one feeder.

An effort was made to use 100-hp. motors where possible, in no case going above 150 hp. All had a synchronous speed of 800 r.p.m. A heavy class of induction motors was employed, these being laid out so that they would be overloaded about 15 per cent, except where change of load was expected, because of change of style, size or twist of yarn on the spinning frames, to get as high an all-day power factor as possible. The power factor actually obtained was 86 per cent, which is relatively high compared with that in many industrial plants using induction motors. The type of motors employed was determined to a great extent by the installation previously made in 1911.

From the tests which were made after installing the drives it was found that the proper loads were obtained on each motor except in a few cases. These were corrected. It was also found that the overload imposed on the motors was not excessive. The total connected load is about 7500 hp. in ninety units averaging 80 hp.

In nearly all cases the motors were mounted on the ceiling close to posts or walls to give solidity and strength, and care was taken to place each motor in its machine group over unused floor space so that it could be lowered in case of burn-out. Care was also taken to keep the driving belts away from machinery where the dirt and belt dressing thrown off would injure the stock in process. Where very high ceilings existed platforms were swung under the motors to facilitate inspection

and oiling, but not necessarily to lower motors upon. As few as possible of these were used as they were recognized as dirt catchers and fire hazards.

The starters were mounted on convenient adjacent walls, directly under iron panel boxes in which are fuses, test clips and the circuit switches. To prevent overfusing by inexperienced persons, a list of the proper size of fuses was posted in each box, together with a printed instruction sheet for starting the motor. As the department overseer is responsible for starting and stopping, this was a valuable aid in the early stages of the game. Later the most fertile source of delays in starting proved to be fuse trouble, so a duplicate set of fuses was installed in each panel box, and these were renewed as they were used up.

A simple system of labeling the motors was perfected by using the mill unit number, the floor on which the motor is installed, and numbering the motors from north to south. Above each service switch was placed on the panel a neat index-card frame about 2½ in. by 3½ in. (6.3 cm. by 8.8 cm.), large enough to give the location, number, size, amount and kind of machinery driven and total horsepower input.

Several new sections of switchboard were added to the old installation, the system being laid out on twenty new double-throw feeder switches, with a double bus

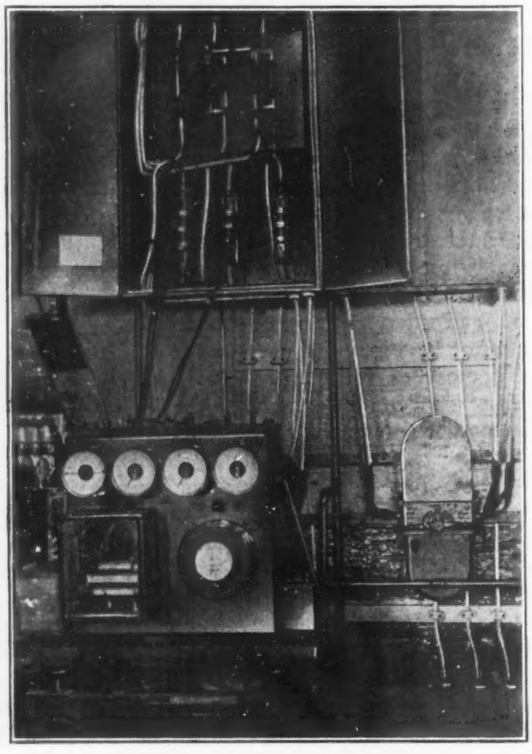


FIG. 3—PORTABLE TEST SET IN USE

Outfit is mounted on truck having rubber-tired wheels and adjusting wheels for leveling. Connections of instruments are shown in Fig. 4.

system that permitted change of motors from purchased power to the Harmony Mills steam power without interruption. The seemingly unnecessary double-bus system was installed because of power contract clauses. Later the abandoned waterwheel generator switches were used as bus ties, and an agreement was drawn up placing the capacity of the steam station at the disposal of the Cohoes company upon reasonable notice. This arrangement has proved its value.

Not having experienced operators, the first trouble developed in starters. It was found that the contact fingers and plates were often burned enough to cause sticking, and sometimes sufficiently to make the motor run single-phase. This resulted because the starting conditions were severe and because the operators were timed. The latter trouble was gradually remedied by

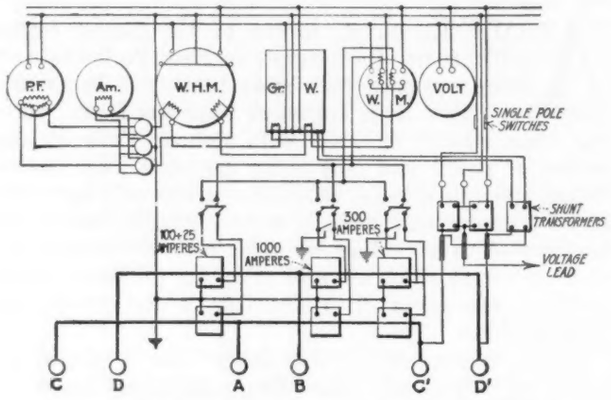


FIG. 4—CONNECTIONS OF INSTRUMENTS ON TEST SET

All of the meters are 5-amp. instruments, three sets of current transformers being provided iwth ratios of 300 to 5, 1000 to 5 and 25, 50 and 100 to 5 for different loads. For a 100-hp. motor the 100-25 to 5-amp. transformers are suitable, while the 300 to 5 is for larger motors. The voltage lead has to be attached to the third leg of the circuit under test. The flexible cables from the test clips are attached to *AB* and *CD* or *C'D'*, depending on load to be measured.

instruction and supervision, but it was found necessary to inspect and renew or clean the contacts about every three months. Records were kept, and where the starters in one department continually became burnt or gave trouble because of the operator's fault another man would be recommended for the starting job. The electrical department of three men found it convenient to repair one starter per day during the noon hour. To do this patterns were made and the castings finished in the mill machine shop, old tips and plates being melted up for stock. A quantity of these contacts are always kept on hand. In the last eight months there has not been any time lost through defective parts or burnt contacts.

So far the motors have given little trouble except what could be prevented or provided against. After the first bearing burnt out one oiler visited all motors every week and reported verbally to his foreman on the condition and cleanliness of each, noting when fuses were blown and that a spare set was left in each panel box. He also made notes of such things as the supporting nuts, a slipping belt or a Pyrene extinguisher partly empty. These small extinguishers are installed at each motor and prove an adequate safeguard against all motor fires. This inspection could be made every two weeks, but daily inspection is preferable to guard against three or more weeks slipping by without its being made. All motors are oiled while running with the exception of three or four where counter-belts are near by, and these are visited during the noon hour shut-down by the oiler.

At the outset part of the motors were of the semi-inclosed type, but the shields seemed to prevent an active circulation of air, hindered cleaning out and served as a "catch-all" for lint and dirt, which finally caught fire due to rubbing of the rotor and overheating. Therefore the end bells were removed and the shields taken out as opportunity afforded until all are now open-type motors.

An air-pressure system of 35 lb. (2.5 kg.) is available for cleaning, and the motors throughout the mills are blown out semi-weekly by the department in which they are running. This is checked by the oiler.

As the manufacturer of the type of motors used is in the West, a spare motor of each size is kept on hand, unassembled, with parts ready on hand trucks for immediate use, and the largest sizes are changed in five hours. Spare sets of coils of some sizes are stocked, and a few coils of the less important sizes, together with bearings, coil clips, slot sticks, empire cloth, etc. All motor repairs and rewinding are done by the electrical department at the mills.

Occasionally a motor gives trouble at an unsoldered lug or coil-end clip, or sometimes a loose rotor bar throws fire. In many cases time was lost looking for an

TEST OF POWER USED

Figures based on electrical input to motor. This cotton mill has 5000 looms, of which about 300 are on print cloths 60 by 56 and 54 by 60, the remainder are on 80 by 80 four-yard goods and some twills and sateens. In the most part goods are made with 28 warp, the filling running from 36 to 24. A limited amount of goods is made with 24 warp and filling.

Cards.—40-in., 680 lb., per Fifty-four Hours

Motor No.	Rated Hp.	No. of Cards	Kind of Drive*	Total Kw.-hr.	Kw.-Hr. per Card	Kw.-hr. Friction Load	Motor Temp., Deg. Fahr.	Time of Test†	Cylinder Speed	Total Hp.	Hp. per Card	
347	100	105	C	102	0.90	17	112	11.00	163.5	136	1.30	36-in. fan
336	100	90	C	90	1.00	14	108	2.15	164	120	1.33	
132	60	55	C	51	0.93	8.5	140	10.00	164	68	1.24	
131	30	29	C	29	1.00	4	114	8.00	166	38.6	1.33	
123	45	36	C	37.5	1.04	3.5	114	1.10	166	50	1.38	

Binder Frame or Speeders.—3½-in. by 7-in. Spindles

Motor No.	Rated Hp.	No. of Frames	No. of Spindles	Kind of Drive*	Total Kw.-hr.	Spindles per Kw.-hr.	Kw.-hr. Friction Load	Motor Temp., Deg. Fahr.	Time of Test†	Total Hp.	Spindles per Hp.
344	60	24	4032	C	57	71	7.5	114	2.30	76.0	53
334	100	40	6720	C	89	75	11.0	118	4.30	118.6	57
I-S-21	45	20	3360	Q	46	73	6.0	104	4.30	61.3	55
I-S-11	45	20	3360	Q	47	72	6.5	124	3.30	62.6	54
124	60	20	3360	C	50	67	6.0	112	9.30	66.6	50

Looms.—32-in. Looms, 180 Picks per Minute; 40-in. Looms, 160 Picks per Minute

Motor No. ¶	Rated Hp.	No. of Looms 32-in.	No. of Looms 40-in.	Total Kw.-hr.	Kw.-hr. per Loom	Total Kw.-hr. Friction	Motor Temp., Deg. Fahr.	Time of Test †	Total Hp.	Hp. per Loom
211	150	...	533	127	0.238	32	108	10.30	170	0.320
212	100	...	395	89	0.225	18	136	11.00	118.6	0.301
213	100	...	348	83	0.238	17	108	8.00	111	0.320
214	100	...	276	63	0.228	14	112	9.00	84	0.304
311	100	111	279	95	0.243	20	128	8.00	126	0.324
312	100	111	279	95	0.243	13	118	3.30	126	0.324
313	100	108	273	90	0.235	19	108	8.45	119.6	0.315
314	100	108	273	90	0.235	13	106	4.30	119.6	0.315
316	150	...	616	132	0.214	30	130	9.45	177	0.288
E11‡	30	78	...	22	0.282	4.5	116	11.00	29.4	0.378
E12‡	45	90	60	42	0.280	7	120	2.00	55.7	0.371
411	100	306	...	93	0.304	18	120	4.15	124	0.405
421	30	90	...	27.5	0.305	5	120	.....	36.6	0.407
422	30	102	...	28.5	0.282	5	128	4.00	38.2	0.378

¶ Motors Nos. 411, 421 and 422 are in rooms where countershafts drive looms only on one floor. All other loom motors drive countershafts belted up to second floor and down to first floor. Belts pulling in both directions reduce friction on the bearings.

Filling Spinning.—Ratio of Cylinder to Spindles 7—1

Motor No.	Rated Hp.	No. of Frames	No. of Spindles	Kind of Drive*	Kw.-hr. Total	Spindles per Kw.-hr.	Kw.-hr. Friction Load	Motor Temp., Deg. Fahr.	Time of Test†	Spindle Speed	Total Hp.	Spindles per Hp.	
233	150	40	10,240	B	114	90	24	102	8.00	7,637	152	67	
234	45	11	2,816	M	32.5	86	8.5	120	3.45	7,658	43.5	64	
235	100	32	8,192	B	83	98	15	140	2.15	7,245	110.5	74	
236	75	22	5,632	B	62	91	12	118	11.20	7,310	82.6	68	
237	75	26	6,656	B	69	96	15	124	10.00	7,280	92	72	
241	75	26	6,656	B	65	102	17	104	8.00	6,508	86.6	77	26-in. fan
331	75	24	6,144	C	63	97	10.5	108	9.00	7,581	84	73	
332	150	48	12,288	C	120	102	21	138	3.40	7,567	160	77	
333	150	48	12,288	C	114	107	20	120	11.30	7,301	152	81	
341	150	48	12,288	C	117	105	18	120	10.00	7,280	156	79	
342	150	48	12,288	C	121	101	27	120	10.00	7,573	162	75	
E3‡	45	14	3,584	B	31	115	5.5	116	10.15	6,664	41.3	87	
E4‡	45	14	3,584	B	37	97	7	104	11.20	6,881	49.3	72	

Warp Spinning.—Ratio of Cylinder to Spindle 7—1

Motor No.	Rated Hp.	No. of Frames	No. of Spindles	Kind of Drive*	Total Kw.-hr.	Spindles per Kw.-hr.	Kw.-hr. Friction Load	Motor Temp., Deg. F.	Time of Test†	Spindle Speed	Total Hp.	Spindles per Hp.‡	
E51‡	45	12	3,072	B	49	63	11.5	118	2.45	8,592	65.3	47	
112	60	8	2,048	C.M.	38	54	7.5	106	9.30	8,792	50.6	41	
113	150	32	8,192	C.M.	138	59	28	123	8.00	8,036	184	44	26-in fan
114	150	32	8,192	C.M.	130.5	63	29	124	1.15	8,176	174	47	26-in. fan
141	150	40	9,600	B	132	73	18	170	4.45	8,302	176	55	26-in. fan
142	45	12	2,880	B	43.5	66	7	120	3.45	8,435	57.6	50	E
143	150	40	9,984	B	144	69	25	122	8.00	.....	192	52	
351	100	22	5,632	B	82	69	11	124	9.00	8,652	110	51	
352	100	22	5,632	B	75	75	10	154	4.30	8,470	100	56	
353	100	22	5,632	B	86	66	10	124	8.00	8,428	114	49	
354	100	22	5,632	B	76	74	11	144	9.30	8,449	101	56	E
355	100	22	5,632	B	80	70	10	146	10.30	8,365	106.6	53	
356	100	22	5,632	B	82	69	10	160	11.15	8,400	109	52	
359	100	22	5,632	B	83	68	13	128	3.30	8,365	110.6	51	E
3510	100	22	5,632	B	83	68	10	118	3.00	8,239	110.6	51	
3511	100	22	5,632	B	88	64	16	120	3.50	8,169	117	48	26-in. fan
3512	75	18	4,608	B	73.5	63	11.5	138	4.30	7,875	98	47	26-in. fan

* C denotes countershaft drive, M denotes mule-post drive, Q denotes quarter-turn drvie, B denotes bicycle drive. † Boldface indicates p.m.
‡E denotes elevator on this motor. In 1917 the shafting was changed in room driven by motors Nos. 112, 113 and 114. Instead of two main lines with mule-post drives a line of shafting was placed over each line of frames. The total load was reduced from 408.6 hp. to 352 hp., besides giving very much better frame speed. This room is very low-posted and the only one which required a rearrangement of shafting to get good results.

extension cord and light or sending back to the shop for a tool. To provide for these trouble calls a metal kit box was made and equipped with small tools, such as prestolyte tank and brazing burner, pliers, screwdrivers, monkeywrench, file, special rotor wrenches, alcohol torch, lead light, solder, paste, tape, coil clips and one of each of the different sizes of fuses. One man can shoulder the box, the outfit in which is sufficient to cope with most shut-downs which do not necessitate replacing the motor. The box is kept in the shop ready for use at any time, and it has certainly proved valuable in shortening the periods of stoppage. The "boys" take great pride in seeing how rapidly they can handle every trouble.

Reference has been made to test clips in the panel boxes. These are attached to the switch jaw and hinge blocks, as shown in Fig. 5, to permit attaching a portable-truck test outfit consisting of a small slate panel carrying a voltmeter and ammeter, a power-factor meter and integrating watt-hour meter, and a graphic and indicating wattmeter. By inserting the dummy fuses with the testing leads attached in these clips and

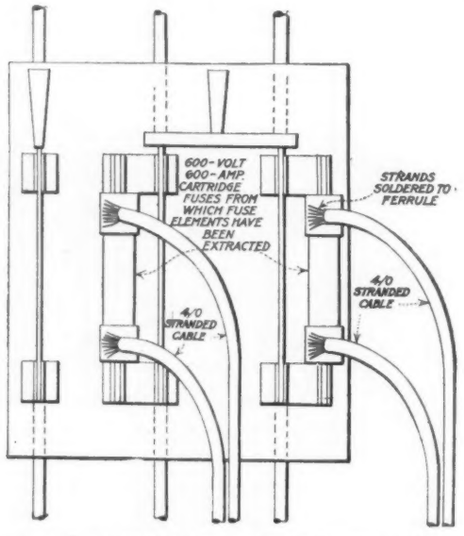

600-VOLT 600-AMP CARTRIDGE FUSES FROM WHICH FUSE ELEMENTS HAVE BEEN EXTRACTED
STRANDS SOLDERED TO FERRULE
4/0 STRANDED CABLE
4/0 STRANDED CABLE

FIG. 5—METHOD OF ATTACHING TEST LEADS

Flexible cables attached to dummy fuses are triple-braided, rubber-covered and are 25 ft. long.

opening the main-line switch, instrument readings can be taken without interrupting service. The results are entered on loose-leaf notebook sheets, together with the date, motor number, pulley sizes, machines driven, speeds and changes in stock or other information that might influence results. This record is kept up to date by the engineer. If changes of stock or speeds are contemplated, the records will indicate how much the motor load can be increased or whether a larger motor will be required. The data also serve as a check on the friction horsepower of each drive, indicating misaligment due to settling timbers in the building, etc. The only condition under which production would have to be temporarily curtailed to permit a test would be when it was desired to obtain data on any particular machines attached to a motor. Friction-load tests can be made during noon hours or at night, while the bearings are still warm, so running conditions are almost duplicated.

The information in this article was contributed by E. B. Tifft, chief engineer of the mill, and by Charles H. Courser, who conducted the investigations made in 1915.

LIGHTING AND CONTROL FOR BRIDGE OVER THE COLUMBIA

Length of Bridge and Limitations Imposed by Lift Span and Series and Multiple Equipment Were Governing Factors

BY F. H. MURPHY

Illumination Engineer, Portland (Ore.) Railway, Light & Power Company.

SINCE it was evident before building the Interstate Bridge which spans the Columbia River between Portland, Ore., and Vancouver, Wash., that it would be required to handle a very large amount of traffic, and since the streets of each city leading to the bridge were fairly well lighted, special attention was given to the illumination of the bridge as well as its approaches. Therefore some of the factors which were taken into consideration and the method of lighting finally adopted may be of interest to lighting engineers.

The bridge with its approaches is approximately 3½ miles (5.3 km.) long. Near the Vancouver end is a 280-ft. (85-m.) vertical lift span. To accommodate foot passengers a sidewalk is carried along the upstream side of the bridge on cantilever supports just outside the main bridge structure. The roadway is well paved and bordered with roses.

Because of the artistic settings of the bridge it was thought best to use a boulevard-type of lighting fixture, so a single-light post with a cast-iron base and a pressed-steel column with a Novalux head was selected for the approaches. On the bridge structure cast-iron brackets are employed to carry the same type of head. The posts were installed on concrete bases along one side of the roadway of the approach about 300 ft. (90 m.) apart, whereas the brackets on the bridge proper are staggered, one being placed about one-quarter span, 67.5 ft. (20 m.), from the end of each span, making two units per span. The light center is about 13 ft. (4 m.) above the roadway all along. At each end of the bridge and approximately 50 ft. (15 m.) from the main structure are two concrete columns, about 25 ft. (7.5 m.) in height, one on each side of the roadway. Each column is surmounted by a large bronze five-light cluster, the lamp for each unit of the cluster being inclosed in a cylindrical opal-glass casing.

Since the need of illumination ceases on the lift span as soon as it is put into operation, there is no occasion for maintaining electric connections to the lights on this span except when it is in normal position. However, the operation of the span should in no way be permitted to affect the balance of the bridge-lighting system, so the lighting of this section had to be considered separately from the rest, as will be explained later.

Owing to the length of roadway to be lighted, a multiple system of distribution could not be used throughout. On the other hand, a series system was a very unsatisfactory one to attempt to handle on the lift span. A low-voltage multiple switch would develop trouble in such a place as this, and one which would properly handle a series circuit would be very difficult to construct and would be, all things considered, prohibitive in cost. If the lighting units on the Vancouver end of the bridge were to be handled on the same series circuit as the rest of the bridge lighting, and accepting the fact that contact switches on the lift span were out of the question, not only because of unsatisfactory operating characteristics and excessive costs but because any such arrangement would of necessity cut off

all the lights on the Vancouver end of the bridge whenever the lift was out of normal, there remained only two propositions. One was to carry the circuit through the lift span by means of vertical trolleys on either end of the span, running the full height of the lift, and the other was to operate the lighting units on the lift span from the 500-volt circuit used to operate the lift motors, etc., and carry the series circuit underneath the drawbridge span in submarine cable. The first method was expensive, troublesome and dangerous to such an extent that it was not even worthy of further consideration. The second method was expensive and for the relatively small number of lamps to be used could not be justified if any other method was available. Finally, the number of lighting units on the Vancouver end of the bridge was too small to warrant the installation of a separate series system to care for them. Moreover, the distances were easily within the range of a multiple distribution system.

Considering all the factors mentioned, it was decided to use a three-wire multiple distribution, 117-234 volt, alternating-current, for the lighting system on the Vancouver end of the bridge, including the lift span, and to use a series system on the rest of the bridge, including the long approach on the Portland side of the river, a distance of more than 3 miles (4.8 km.). For the posts and brackets on the series system 400 cp., 15-amp. series gas-filled lamps were selected, while for the brackets on the multiple system a 300-watt, 118-volt gas-filled unit was adopted. The lamps used for the towers on the Portland end of the bridge were 250-cp., 6.6-amp. series gas-filled units and those for the towers on the Vancouver end were 200-watt, 115-volt gas-filled lamps.

On this roadway it was desirable that some lighting be maintained throughout the night, but it was unnecessary that the entire system be maintained after midnight. Arrangements were therefore provided for turning on all the lights of both systems early in the evening and leaving them on until midnight, at which time the towers, the brackets on the down-stream side of the bridge and every alternate post on the Portland approach to the bridge, except in two or three instances, where curves in the driveway made it inadvisable to do so, were to have the light turned off. The remainder of the lights were to burn until daylight. The control of these circuits, both multiple and series systems, was made entirely automatic by means of time switches. Automatic control was decided upon because the personal patrol of the system three times a day—evening, midnight and daylight—for that location seemed inadvisable and the cost of providing for control of the systems from substations in either city was prohibitive.

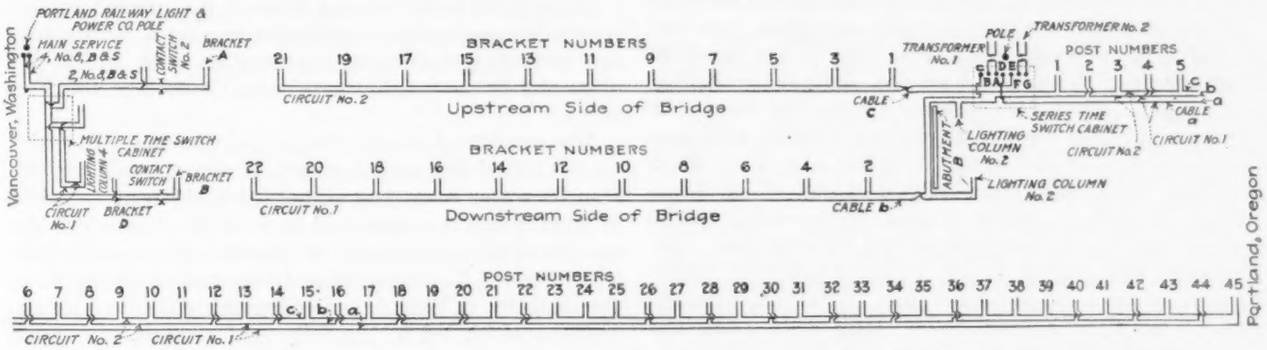


FIG. 1—LIGHTING DISTRIBUTION SYSTEM USED ACROSS COLUMBIA RIVER, WITH PROVISION FOR REDUCED LIGHTING AFTER MIDNIGHT

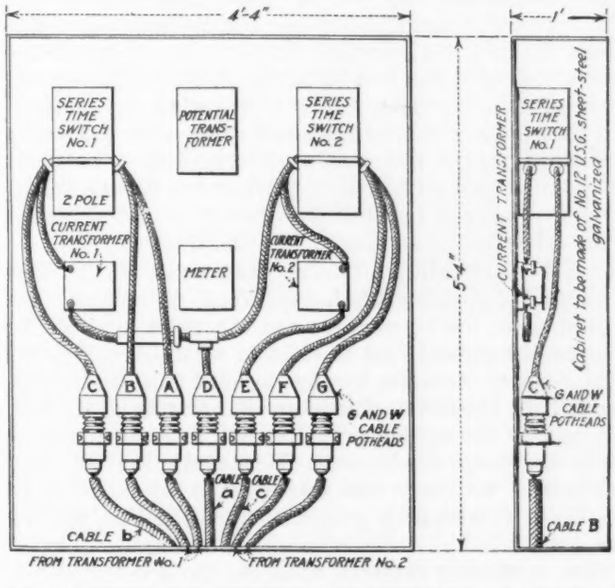


FIG. 2—SERIES TIME SWITCHES ARE EMPLOYED AS MEANS TO CONTROL SERIES LAMPS

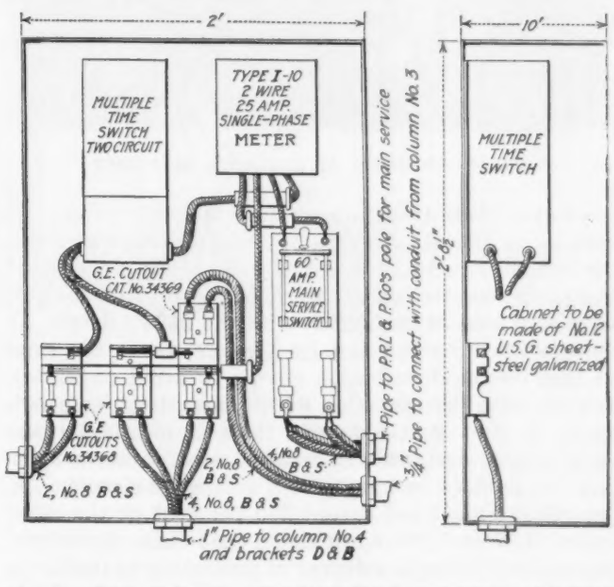

2'
10'
MULTIPLE TIME SWITCH TWO CIRCUIT
TYPE I-10 2 WIRE 25 AMP. SINGLE-PHASE METER
MULTIPLE TIME SWITCH
G.E. CUTOUT CAT. No. 34369
60 AMP. MAIN SERVICE SWITCH
Cabinet to be made of No. 12 U.S.G. sheet-steel galvanized
G.E. CUTOUTS No. 34368
2, No. 8 B & S
4, No. 8 B & S
2, No. 8 B & S
4, No. 8, B & S
3/4" Pipe to P.R.L. & P. Co's pole for main service
3/4" Pipe to connect with conduit from column No. 3
2'-0 1/2"
1" Pipe to column No. 4 and brackets D & B

FIG. 3—TIME SWITCH AUTOMATICALLY CONTROLS MULTIPLE BRIDGE LAMPS

Securing a time switch for control of the multiple system was a simple matter, but for the series system it was a much more difficult problem. Time switches for handling series circuits of the capacity required and of a type that seemed dependable were not available at the time. Furthermore, the only service available where it was desired to feed this system was 11,000-volt.

Since standard constant-current equipment was not available for reducing the 11,000 volts to the standard 2300 volts for the primary service, some other method was sought. The series-multiple system had been used for such purposes on smaller voltage circuits with success, so it was decided to use it in this case also. Such a method would save the purchase of one set of transformers as well as provide a considerable saving in the cost for housing the constant-current transformers. Accordingly two special 10-kw. constant-potential transformers were used, designed for 11,000-volt primary and 6.6 amp. at approximately 1500 volts from the secondary circuit with two 5 per cent taps in the primary windings and four 5 per cent taps in the secondary

FIG. 4—LIGHTING AT ENTRANCE TO BRIDGE

windings. Auto-transformers were selected for use with each lamp. The 6.6-amp. distribution current was transformed to 15 amp. for the 400-cp. lamps used in all the posts and the series brackets. Auto-transformers were also used in connection with the 250-cp. lamps, although the current taken by the lamps was the same as that on the distribution circuit to avoid any interference with the operation of the circuit by lamp outages. It was specified that these auto-transformers should be so designed that when tested at normal primary current (sine wave), with secondary circuit open, the voltage must not exceed 250 per cent of the rated value. It was further stipulated that these transformers must afford such a degree of protection to the lamps that primary current might be increased to at least 150 per cent of normal value before the secondary current reached the burn-out current value of the lamps.

With the foregoing provision it is assumed that any reasonable number of lamp outages will in no way seriously affect the satisfactory operation of the system. The correctness of this assumption has been amply borne out by the results of a year's operation, during which time, as a result of accidents, several posts have been damaged and it has been necessary not only to remove the lamps but also to shunt the auto-transformers for a time. This seemed in no way to affect the other lamps.

WATER CONSERVATION FOR MASSACHUSETTS

Discussion Before Legislative Committee by Public Officials Emphasizes Importance of Utilizing Water Power Now Wasted

Much hard work is being done at the present session of the Massachusetts Legislature to pass a satisfactory law providing for water conservation both within the state and in coöperation with New Hampshire and Vermont.

The committee on waterways and terminals, to which was referred the recent report of the special commission on water resources, presented a bill near the close of April which was designed to furnish a basis for storage development under state supervision along the lines recommended in the report and previously referred to in the ELECTRICAL WORLD, and endeavoring also to meet objections which led to the failure of a conservation bill at the recent legislative session in Vermont. The bill provides that the courts of the state in which storage facilities are located shall hear appeals from the action of any joint board of supervision or control relative to operation or tolls. Another important feature is that before the cost of a storage development can be assessed upon the owners of water rights upon a stream a majority of such owners both in interest (expressed in gross workable head) and in numbers must consent. Supervision of such projects and their operation would be under the commission on waterways as previously outlined.

At a hearing lately before the ways and means committee the whole question of conservation was thrown open for discussion. A. R. Weed, chairman of the Massachusetts Gas and Electric Light Commission, and John N. Cole, chairman of the Commission on Waterways, defended the bill. Both emphasized the importance of utilizing water power now wasted and contended that the interests of the small power user and water privilege owner are amply safeguarded. Chairman Weed said that with coal at $10 per ton the unutilized and undeveloped hydroelectric power of the principal Massachusetts rivers totals $12,000,000 per year.

To a representative of the ELECTRICAL WORLD and also at the hearing Chairman Weed maintained that agitation in the newspapers and otherwise against the bill on the ground that it seeks to establish control of water-power resources by any so-called trust is entirely aside from the facts. The most vital feature of the bill, he said, is the section providing for interstate coöperation in storage development. He stated that if absolute agreement by every mill owner is to be required to realize a conservation program, no legislation will be needed.

The opposition centered upon the feature of the bill which might require a water privilege owner to pay an assessment for water which it could not utilize in power production and upon the proposal to make assessments a lien upon his property. The Holyoke Water Power Company urged an amendment to the effect that no owner of any improved or operated water mill or dam shall be assessed an amount in excess of the actual benefits derived by such owner from the creation of such water storage. Many mill owners opposed the bill on account of its toll provisions.

It was decided to continue the hearing pending a conference to discuss recommendations by both sides.

Experiences with Electrolytic Arresters

Tests at 110 Stations of Southern California Edison Company Indicate Need of Giving Particular Attention to Condition of Horn Gaps, Film and Electrolyte, Oil, and Line and Ground Connections

WHILE the electrolytic lightning arrester has been found very effective in protecting station equipment from disturbances due to switching and lightning strokes, it is seriously affected by continued overloads and has the disadvantage of having to be charged, inspected and maintained at frequent intervals. Furthermore, its satisfactory operation depends to a great extent on the setting of the horn gaps, condition of the films and electrolyte, condition and quantity of the oil, and condition of the line and ground connections. The necessity of charging is not such a serious objection except in isolated places, but if this type of arrester is overloaded for any length of time the electrolyte becomes overheated, causing the films to be dissolved with great rapidity, resulting in failure.

In view of these facts, a committee was formed on the Pacific Coast early in 1915 to report on the care and attention to give lightning arresters and methods of testing them. In addition, it was desired to determine whether or not the periodic testing of arresters is a warranted expense. To facilitate this investigation test jacks were installed on the 66,000-volt arresters at three of the Southern California Edison Company's large plants, and a current-testing set was purchased. Periodic tests were made and records kept of all indications of the condition of the arresters, particular attention being given to the current at the time of charging and the color and size of the arc at the horns breaking the current. Other conditions noted were the time of charging, frequency, temperature, any peculiar or unusual sounds coming from within the arrester tanks, the condition of the grounds and the quantity of oil.

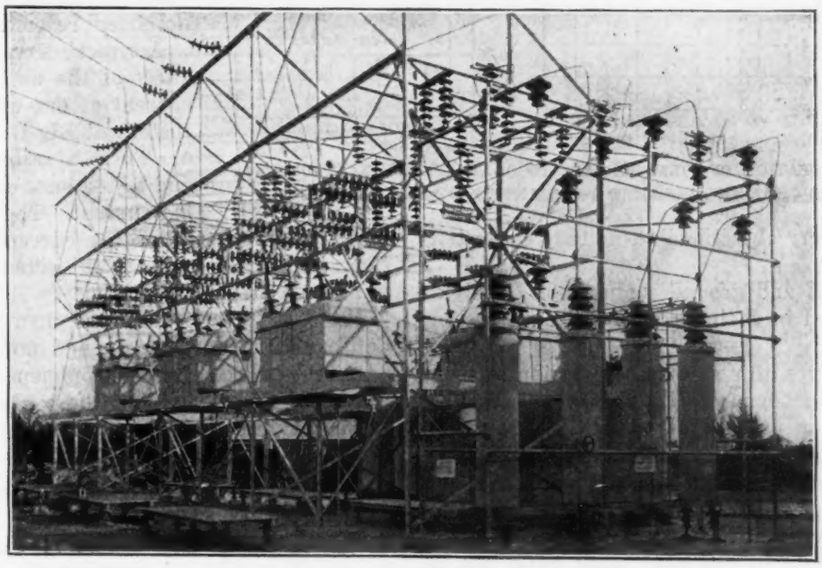


FIG. 1—ONE OF THE STATIONS AT WHICH PERIODIC TESTS OF ARRESTERS ARE MADE

However, it soon became evident that the restriction of the tests and observations to such a limited number of arresters would require an undesirably long time to obtain intelligent results from which conclusions and recommendations could be drawn. Furthermore, the expense of equipping all the arresters with testing jacks had not been warranted yet, so an attachment was devised which could be used in connection with the regular test set to place the ammeter between the horn and short-circuiting strip at the time of charging. In time, all arresters at 110 different stations, ranging in potential from 2200 to 150,000 volts, were tested, and the results showed conclusively the need for periodic testing and inspection.

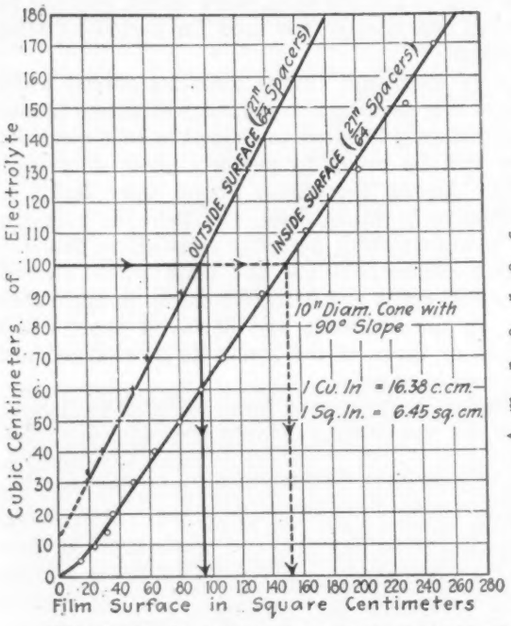
Some very important things were discovered which showed that it is necessary to pay more attention to electrolytic arresters if they are to be kept in such condition that they will be ready to perform their duty most effectively. Among the things found were leaky oil tanks, defective bushings, loose and too-wide horn-gap settings, loose insulators, defective resistances, deteriorated ground connections, low and deteriorated electrolyte, punctured cones and defective charging apparatus, especially on the 2000-volt and 6600-volt type, which allowed two or three of the stacks to be charged and not the remaining ones.

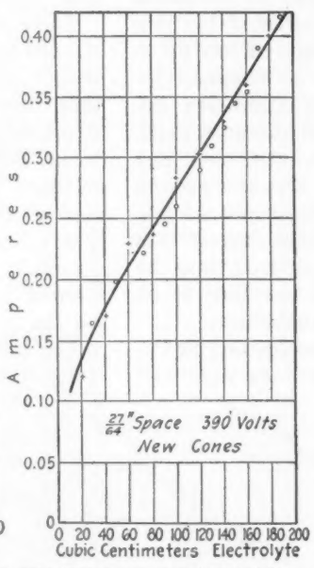
The leaky oil tanks caused lowering of the oil level, which not only reduced the insulation necessary but exposed the electrolyte to evaporation. As a result of a cracked bushing on a 60,000-volt arrester the compound gradually melted and leaked into the tank. Punctured cones were usually indicated by a cracking or rumbling noise coming from the tanks. When this occurred the tanks were ordered overhauled, invariably revealing one or many punctured cones, which were replaced by new ones. In some cases the whole set of arrester tanks were overhauled at the same time.

Loose horn gaps and too wide settings are particularly objectionable, because the first defect makes it impossible to depend on the gap discharging at the same voltage each time while the second fault eliminates part of the protection which should be afforded. In general, the horn-gap defects are due to the construction employed and aging of the equipment, but they can be reduced by keeping the frames painted, tightening all bolts periodically, and checking the settings regularly, especially on the larger-voltage installations where heavy parts are used on the movable arms.

Damage to the charging resistances was in many cases due to mechanical stresses or excessive heating during sustained discharges which start at the resistance gap, rise on the horn, go out, and repeat again and again. Where a resistance rod had become broken parts fall out quite often, leaving a gap which, if not

bridged by the charging current, forces the arc over the main gap, subjecting the cells to a charge without any limiting resistance. In some cases this would be so excessive as to cause dissolution rather than formation of the film, leaving it exposed to damage by the dynamic current. The charging resistances, while desirable because of their effect on the charging current, are also desirable in damping surges set up during charging.


Cubic Centimeters of Electrolyte
Film Surface in Square Centimeters
OUTSIDE SURFACE (27" Spacers)
INSIDE SURFACE (27" Spacers)
10" Diam. Cone with 90° Slope
1 Cu. In = 16.38 c.cm.
1 Sq. In. = 6.45 sq. cm.



FIGS. 2 AND 3—RELATION OF FILM SURFACE TO QUANTITY OF ELECTROLYTE; RELATION OF CHARGING CURRENT TO QUANTITY OF ELECTROLYTE

These surges are very objectionable, as they cause telephone interference.

Without good line and ground connections the lightning arresters failed in their purpose and even became a menace.

As to the electrolyte, this seemed to deteriorate spontaneously quite independently of the natural chemical reaction resulting from passage of current. Cases were observed where fungus, similar to "mother" of vinegar, had formed, causing part of the electrolyte to turn into acetic acid—a rather objectionable constituent because it has a high dissolution effect on the films.

Although the height of the electrolyte could not be determined at first until the cones had been taken apart, it was found later that low electrolyte could be detected by a low charging current, since the decreased electrolyte reduced the effective contact area between cones. This was verified by measuring the quantity of electrolyte in a 30,000-volt arrester which had indicated a very low value of charging current. The cones were in fair condition. The quantities of electrolyte (in cubic centimeters) found in them appear in the table on the opposite page.

Whereas the cones should have contained 178 cu.cm. of electrolyte apiece, it was found that the average quantity was only 100 cu.cm., giving a film surface of 97 sq.cm. on the lower side of the cones and 152 sq.cm. on the upper side with 27/64-in. spacers. The relation between quantity of electrolyte and film surface is given in Fig 2. The decrease in electrolyte, barring incorrect measurement when filled, can only be laid to evaporation.

Since the charging current is proportional to the area of the film in contact with the electrolyte, it is of prime importance that the full quantity be maintained in each cell because the ability of the arrester to absorb high-frequency transients depends upon the electrostatic capacity rather than on the discharge capacity. Also, when the arrester discharges it is of great importance to have the maximum film area in order that the heating shall not be excessive enough to cause dissolution of the film. The correct relation between charging current and quantity of electrolyte is given in Fig. 3 for the arresters under consideration.

Some tanks were found with a charging current of 1 amp., which was three times normal for the type of arrester observed. For such cases charging two or three times a day was recommended to bring the current down to normal. In case this treatment failed the tanks were overhauled and new electrolyte put in after washing the cones.

As far as is known at the present time the local weather conditions, which do not go to extremes of hot and cold, do not greatly affect the operation of the arresters, so that the unsatisfactory and expensive methods of cooling or of heating the arrester tanks to offset these conditions have not been resorted to.

A typical curve showing the possible effect of the weather on the charging current of one of the 150,000-volt arresters at Big Creek is shown in Fig. 4. These arresters are charged daily and tested once each month for charging current. The curve represents the values of highest charging current for any particular tank. This installation is subjected to both hot and cold weather extremes in season.

Prior to the observations mentioned, the Southern California Edison Company had more or less followed the arrester manufacturers' recommendations regarding the frequency of overhauling the tanks. Since then, however, the test department determines this point, the arresters now being tested once every three months for

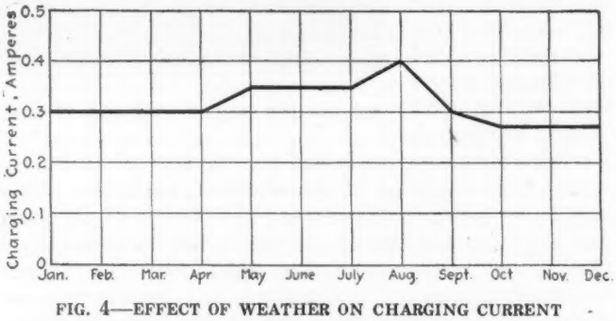


FIG. 4—EFFECT OF WEATHER ON CHARGING CURRENT

this purpose, and a card record of the performance of each arrester tank on the system is kept on file. On the field records (Fig. 5) are recorded such data as location, make, type and serial number, charging current, character of arc and gap setting, resistance, and remarks regarding condition of grounds, resistance rods, framework, etc. These data are turned into the test department by the test man, where they are transferred to permanent file records (Fig. 6), one card being kept in file for each arrester, thus affording a continuous history of each arrester's performance. At the same time the department makes recommendations to the di-

visional superintendent for overhauling, repairing, etc., on the form shown in Fig. 7, data for which are taken from the file and test record report. On receipt of this form the department superintendent authorizes the work done and on completion notifies the test department through a postal medium. The arresters are again checked and inspected to determine whether they are in first-class condition for service. By this means a great deal of expense can be saved by not overhauling the arresters until their performance indicates that this is necessary, and also by overhauling such arresters as show the need of it before they fail. A failure would cause a much greater expense than simple overhauling, and involve the possible loss of apparatus left unprotected because of a faulty arrester.

To facilitate making these periodic tests, which are now recognized as fully warranted, ammeter test jacks

FORM TEST 24

SOUTHERN CALIFORNIA EDISON COMPANY

LIGHTNING ARRESTER TEST REPORT

STATION Los Angeles #3 DATE 2-13 1919

CIRCUIT West Kern 60 K.V. TYPE I-C-2
MAKE General Electric NO. 7370
VOLTAGE 58500/64250
CONDITION Rumbling in #2 tank
GAP SETTINGS. MAIN 3 3/4" RESISTANCE 3"

RESULTS OF TEST

ARRESTER	No. 1	No. 2	No. 3	No. 4	REMARKS
AMPERES	.20	0 to .2	.20		#2 Chg Annex
ARC	2 B	3 B	2 B		Variable

CIRCUIT East Kern 60 K.V. TYPE I-C-2
MAKE General Electric NO. 7369
VOLTAGE 58500/64250
CONDITION O.K
GAP SETTINGS. MAIN 3 3/4" RESISTANCE 3"

RESULTS OF TEST

ARRESTER	No. 1	No. 2	No. 3	No. 4	REMARKS
AMPERES	.24	.24	.22		
ARC	2 B	2 B	2 B		

CIRCUIT L.A. #2 North TYPE I-C
MAKE General Electric NO. 6813
VOLTAGE 16100/18700
CONDITION Charging current #3 high. Resgap wide
GAP SETTINGS. MAIN 1/2" RESISTANCE 9/16"

RESULTS OF TEST

ARRESTER	No. 1	No. 2	No. 3	No. 4	REMARKS
AMPERES	.24	.26	.70		Tank #3
ARC	1A	1A	3C		Noisy

REMARKS Arresters #73 #0 and #68 #3 need attention.

TESTED BY A R Arnold ENTERED

FIG. 5—FIELD RECORD OF LIGHTNING-ARRESTER CONDITION

have been attached to all the arresters, since they are more convenient to use and safer from the standpoint of the tester and apparatus. Of course, it is possible to make tests without them, and possibly as cheaply. A portable recorder is used, which is moved from station to station as desired. This gives information regarding the time at which discharges occur. If the discharge is frequent, it is the usual indication that the arresters are working properly and that the gaps have the right setting. If, on the other hand, the discharge is infrequent, the gaps should be reduced. On account of the conditions varying in different parts of the system, this recorder has been found to be very helpful in determining the proper settings of gaps and for indicating whether or not the operator has charged at the proper intervals.

In overhauling the arresters, the stacks are dismantled and each cone is carefully cleaned, using cheesecloth and gasoline for the first operation, followed by a bath in denatured alcohol to remove the greasy film left by

ELECTROLYTE FOUND IN LIGHTNING-ARRESTER CONE

Cone No.	Tank 1	Tank 2	Tank 3	Cone No.	Tank 1	Tank 2	Tank 3
1	48	93	102	27	90	109	95
2	65	102	102	29	102	109	102
3	90	95	99	31	85	109	95
4	105	109	89	33	102	89	102
5	65	116	89	35	122	93	102
6	100	109	79	37	100	109	108
7	100	109	79	39	110	113	102
8	110	102	83	41	102	102	106
9	110	102	83	43	102	102	106
10	75	95	89	45	102	109	133
11	75	102	89	47	113	109	114
12	78	109	99	49	110	102	106
13	82	116	102	51	102	109	108
14	88	109	106	53	90	109	106
15	90	99	102	55	110	95	106
17	117	102	102	57	97	102	102
19	110	116	102	59	102	130	108
21	102	93	83	61	102	109	108
23	136	113	95	Average,	97	105	100
25	97	93	95				

the gasoline and also the brown sludge ring left at the edge of the film of the area. Cones that cannot be thoroughly cleaned by this method are replaced by new cones. New cones are used in the same stack as the old cones if the amount does not exceed 10 per cent of the stack. The old cones are returned to the general storeroom to be passed on by the test department, while heavily pitted, punctured or badly dented cones are rejected and sold as junk. Most of the deposits found on the cones can be removed by a bath in a weak solution of hot caustic soda, after which they are thoroughly rinsed in warm water. After drying, the cones are immersed, two at a time, in a small vat of electrolyte and charged thirty seconds by a current of 0.5 amp. It is not expected that the films will be completely re-formed by this method, but, as the cones are always charged up after building the stacks (just before putting them into service), it is believed that the charge is sufficient for the film area. These cleaned cones are stacked on frames in a manner similar to that in which they are received from the manufacturer and placed in the general stores department awaiting call. The cost of cleaning and charging cones averages about 10 cents each. Approximately 99 per cent of the cones received are returned to service after this treatment.

In some places on the system it is impossible to obtain low potential for forming the film on cones, in which cases the whole stack of cones is placed in the arrester tanks complete and charged by the use of a separate line from a generating plant by reduction in voltage, giving a ten-second charge at about one-fourth voltage and then increasing the speed at the plant to one-half, three-fourths and finally full voltage, giving a charge at each voltage. In this way the proper film is formed and the results obtained are satisfactory. Where a separate line and generator cannot be procured, the chance of arrester trouble is increased by energizing the tanks on a high-potential line with full voltage, unless the film has first been formed at a lower voltage.

The stock of electrolyte kept by the general store department is occasionally tested to determine whether or not it is fit for use or has started the fungus growth, and all the electrolyte before being shipped to any point for use is tested immediately before shipment. This is done for two reasons: To keep the stock up to a certain standard quantity and to prevent any bad electrolyte getting out on the system.

Quite a few isolated stations are equipped with electrolytic lightning arresters which have been charged, inspected and maintained by a patrolman. This practice is not as satisfactory as having a permanent station atttendant because the arresters are more susceptible to trouble where no operators are in attendance, which indicates that they do not receive the proper attention. To avoid this difficulty oxide-film aluminum arresters have been ordered for a number of the isolated stations, in the hope that they will take care of themselves as they seal over after each discharge. If they operate as claim is made for them, the company will undoubtedly replace quite a few of the electrolytic arresters with the oxide-film type.

The best charging practice involves the utilization of a resistance in series with the tanks during the interval of ten seconds that is required each day to re-form the films. This resistance must be high enough to prevent an excessive inrush of current in case the films are in bad condition and at the same time must not be high enough to prevent the cells from getting their normal potential, as the critical voltage of the film depends on the voltage at which it is charged. The value of the resistance selected on this system is such as to limit the current to a maximum of about 10 amp. at the voltage for which the arrester is designed, if the cells were completely short-circuited. This is easily possible, due to the fact that the arrester is typically a condenser bringing the resistance drop in quadrature with the impressed voltage.

During the past two years of investigation one particularly significant point has been brought out, and that is that out of seven arrester failures all occurred in three-tank sets either directly from lightning or owing to insulator failure on the arrester equipment. This seems to indicate that four-tank arrester installations should be used in preference to the three-tank, Y-connected sets. While it is true that three-tank arrester installations may be satisfactory in cases of a grounded neutral system where the stability of the ground is assured, conditions affecting grounding of all kinds in southern California are difficult and erratic, and it is quite possible for a grounded arrester to be so affected by some local condition that it does not get the benefit of the grounding of the neutral of the system. It is also possible that under some conditions of switching the arrester may for a time be on an isolated section of line and therefore should be protected by the fourth tank.

The foregoing information and illustration were kindly contributed by W. R. Frampton, superintendent of the meter test department of the Southern California Edison Company.

FORM TEST 58 SO PAGE 12-17

SOUTHERN CALIFORNIA EDISON COMPANY

STATION OIL AND LIGHTNING ARRESTER REPORT

OIL — ARRESTERS

LOCATION Los Angeles #3 DATE 2-13 191 9

APPARATUS	SERIAL NO.	GRADE OIL	TEMP. °C	BREAK DOWN K.V.	SERIAL NO.	TANK NO. 1 CHARGING CURRENT	TANK NO. 1 CHARACTER OF ARC	TANK NO. 2 CHARGING CURRENT	TANK NO. 2 CHARACTER OF ARC	TANK NO. 3 CHARGING CURRENT	TANK NO. 3 CHARACTER OF ARC	TANK NO. 4 CHARGING CURRENT	TANK NO. 4 CHARACTER OF ARC
					West Kern #7370	.20	2 B	0 to.2	3 B	.20	2 B		
					East Kern #7369	.24	2 B	.24	2 B	.22	2 B		
					L.A. #2 No. #6813	.24	1 A	.26	1 A	.70	3 C		

Tank #2 in Arrester #7370 rumbles when charged. Indications of punctured cones.

Tank #3 in Arrester #6813 very high in charging current and tank noisy.

Recommend that both these tanks be overhauled at once.

NOTE—THE NUMERALS 1 TO 4 INDICATE THE SIZE OF THE ARC FOUND WHEN BREAKING THE CHARGING CURRENT. NO. 1 INDICATING A MINIMUM SIZED ARC AND NO. 4 THE LARGEST SIZED ARC ENCOUNTERED IN PRACTICE. NOS. 2 AND 3 ARE INTERMEDIATE GRADES. THE LETTER A INDICATES A WHITE CRACKLING ARC AND LETTER D RED FLARING ARC. B AND C ARE INTERMEDIATE STAGES.

FORM TEST 58 500 11-17

SOUTHERN CALIFORNIA EDISON COMPANY

LIGHTNING ARRESTER TEST RECORD

MAKE G. E. TYPE S-C-3 VOLTAGE 48500/64250

LOCATION L. A. #3. CIRCUIT West Kern 60 KV

TANK NO. 1 2 3 SER. NO. 7370

DATE OF TEST	CHARGING CURRENT	CHARACTER OF ARC.	GAP SETTING MAIN	GAP SETTING RES.	REMARKS
6-1-16	.28	2 B	3 3/4	3	
9-19-16	.26	2 B	3 3/4	3	
12-6-16	.23	2 B	4	3 1/4	Horn loose, adjusted
2-31-17	.23	2 B	3 3/4	3	
6-11-17	.27	2 B	3 3/4	3	
9-4-17	.30	2 B	3 3/4	3	
12-18-17	.25	2 B	3 3/4	3	Checked gap setting
3-3-18	.25	2 B	3 3/4	3	
6-4-18	.30	2 B	3 3/4	3	
9-18-18	.30	2 B	3 3/4	3	
12-10-18	.34	2 B	3 3/4	3	Checked gap setting
2-13-19	0 to .2	3 B	3 3/4		Tank #3 rumbles when charged Recommend overhauling
2-21-19	.22	2 B	Pulled after overhauling		Found 3 cones punctured.

FIGS. 6 AND 7—PERMANENT CARD RECORD OF ARRESTER HISTORY; FORM SENT TO DIVISIONAL SUPERINTENDENT WHEN RECOMMENDING OVERHAULING OF ARRESTERS

INDUSTRIAL APPLICATIONS

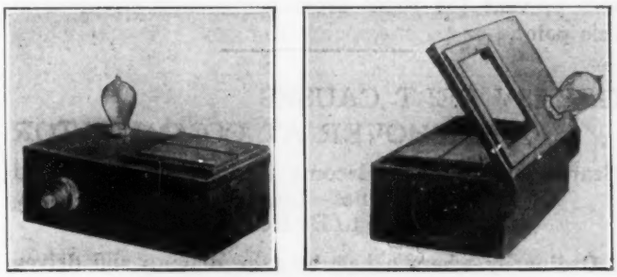
The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

DEMAGNETIZER MADE FROM OLD REGULATING REACTOR

Energized by Alternating Current to Avoid Use of Cumbersome Direct-Current Device—Employed to Treat Steel Products

When magnetic chucks are used for grinding purposes, some method has to be employed for demagnetizing the steel products after they have been ground. Direct-current demagnetizers in which the current is reversed by some rotating device are sometimes used, but one company in the East has found it advantageous to use an alternating-current demagnetizer because it eliminates moving parts. In the plant where this is used 220-volt alternating current was already supplied to a nearby machine motor, so special wiring did not have to be provided.

The demagnetizer employed was made from an old regulating reactor taken from a mercury-vapor lamp by



FACE PLATES SEPARATED BY INSULATION PROJECT THROUGH OPENING IN BOX COVER

sawing the yoke in two and attaching face plates thereto. A space of about 0.12 in. (3 mm.) was provided between the adjacent ends of the yoke and the face plates so that too much flux would not be shunted across the gap. Thus the demagnetizer can be used without making temporary connections, and in order that it might be transferred from one spot to another it was placed inside a box on which were mounted a snap switch and a lamp, connected in the secondary circuit to increase the flux and serve as a current-indicating device.

DEEP-BOWL REFLECTORS FOR CLOSE MACHINE WORK

Equipped with 100-Watt Gas-Filled Lamps and Placed 10 Ft. from Floor, They Form Effective Lighting Scheme with Few Additional Lamps

Obtaining from 3.5 to 4 foot-candles on the working plane, without a particle of glare, at the expense of only 0.64 watt per square foot (0.06 watt per sq.m.) of surface is the record of a large industrial plant in the East. This is accomplished by placing 100-watt gas-filled lamps in Benjamin fluted deep-bowl reflectors on 12.5-ft. (3.8-m.) centers about 10.5 ft. (3.1 m.) from the floor. For finer work, however, 150-watt lamps can be used if necessary because the reflectors are of the 200-watt size. In a few instances individual incandescent lamps are mounted on the machines, but this is only done where an operator has to do internal boring and must look into the bore for the purpose of adjusting his tool.

No covering is used over the top of the reflector in order to procure adequate ventilation. The small amount of light thus escaping is utilized as indirect lighting from the white ceiling.

Plainfield, N. J. IRVING E. SWEAZEY.

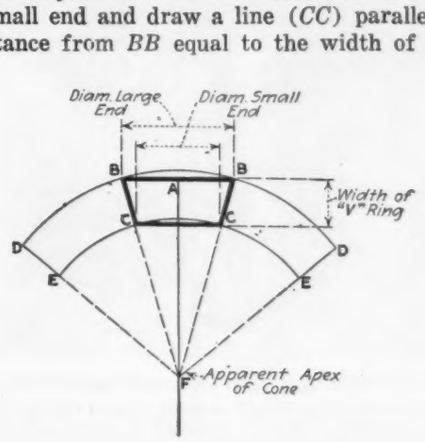
CUTTING RINGS FROM SHEET MICA

Method of Assuring Exact Fit with No Calculations—Tapping Allowed for in Determining Length

An armature winder often experiences much difficulty in cutting a "V" ring from a sheet of mica in such a manner as to obtain a perfect fit. A simple method of getting an exact fit is described in the following paragraphs:

Assume that the beveled surface to be covered with mica is a section of a cone the apex of which would extend to the heart of the shaft at a point which would be the intersection of two lines drawn as the continuation of a "V" ring toward the heart of the shaft.

First, draw a perpendicular line (*AA*) on the mica sheet. Take caliper measurement of the large end of "V" ring and place this measurement (*BB*) at right angles with *AA*, taking care that the latter cuts the former exactly in the center. Measure the diameter of the small end and draw a line (*CC*) parallel to and at a distance from *BB* equal to the width of the "V"



METHOD OF LAYING OUT MICA "V" RING

ring. Connect *B* and *C*, both sides, extending lines to *AA*. Call this intersection point *F*, or the apparent apex of cone. Using *F* as a center and *B* as a radius, describe a large arc. Repeat this operation, using *C* as radius. This gives the proper curve and width of

the mica "V" ring, but to eliminate waste the length should also be known.

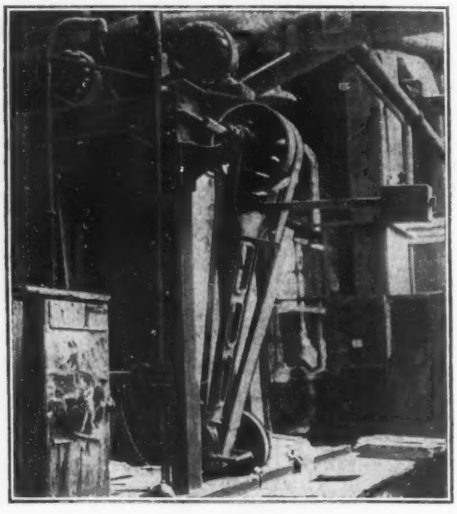
The exact length is not needed, and its attainment would be impracticable for two reasons: First, it would involve too much figuring for the average armature winder; second, because provision must be made for "welding" mica "V" ring ends together. Therefore the exact length would be too short. To get the needed length encircle the large end of the "V" ring with a piece of banding wire, allowing an extra inch for welding. Set this measurement on the larger of the two arcs and mark off points *DD*. After connecting points *DD* with apex *F* the "V" ring is properly laid out and ready to cut.

Youngstown, Ohio. M. S. CLEMENT.

DOUBLE-FRAME MOUNTING FOR SEPARATE CROSS-CUT SAWS

Motors Ordered for Direct Drive Being of Too Large Dimensions, Some Method Had to Be Used to Give Effective Nearby Drive

Ordering motors by rating without specifying outside dimensions sometimes leads to a difficult installation problem when motors are too large. An instance of this kind happened to the Eclipse Box & Lumber Company of Greenpoint, Long Island, some time ago when the 2-hp. motors received measured 10.25 in. (26 cm.), whereas the space allotted for them on the horizontal shaft was only 8.25 in. (21 cm.) in length. As some framework had to be constructed to hold the saws, it was decided to combine the two saws on a square I-beam mounting and thus utilize the framework of one for the motor support of the other. Pulleys were placed on the shafts and the motors were bolted to the top of the iron framework, the belts passing on



FRAMEWORK OF ONE SAW USED AS MOTOR MOUNTING OF OTHER

Motors should have been placed on pulley shaft, but space provided was found to be 2 in. short after motors came.

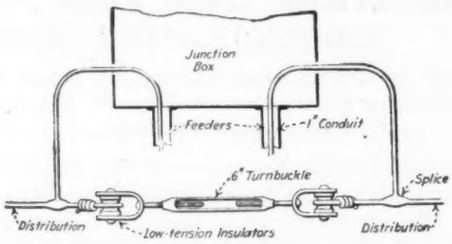
each side of the horizontal top pieces. In this position the motors are easily accessible and do not get so dirty as they would if placed closer to the cutting edge of the saw.

The motors are conveniently controlled by safety switches placed on the framework. The conduit runs directly up the side of the framework, the wires being distributed through a condulet.

SIMPLE FEEDER ARRANGEMENT PREVENTS WIRE SPLICING

A Number of Feeders Coming from One Source Are Effectively Directed at Right Angles by Running Through a Main Junction Box

Where a number of parallel feeders are directed to their respective positions at one diverging point care must be taken to avoid a mix-up of wires and too many



DISTRIBUTION FEEDERS DEAD-ENDED ON EACH OTHER

splices. An arrangement which makes this a simple matter is in use in a rubber mill in New Jersey where the wires from the supply are in a number of conduits arranged in two rows. These conduits terminate in a junction box, and the wires run directly to the distributing feeder without a splice. Here they are attached to the feeder, which is dead-ended to a turnbuckle with another dead-ended wire on the opposite side. Insulators prevent the wires from being short-circuited at this point.

GREASY BELT CAUSES FLASHOVER AT COMMUTATOR

Bearings and Pulley Become Hot and Reduce Speed of Driven Machines—Load Had in Consequence to Be Reduced

Ordinarily where a belt between driving and driven pulleys is horizontal or nearly so, and the pulleys are sufficiently far apart and so turn that the tight side of the belt is under, the additional sag which obtains when load is applied increases the arcs of contact between the belt and pulleys and helps to prevent belt slipping. Where available space requires that the pulley alignment be vertical, however, the sagging effect helps but little, and it then may be necessary to operate with excessive belt tension.

A 550-volt, 45-hp. motor used for driving shop shafting flashed over and blew its breaker; as the flash apparently burned the commutator and brush holders badly, the trouble was hastily attributed to armature defect, but this was not found to be the case. Soon afterward complaint was made of the slowness of the connected machines and an investigation was again made.

The machine was found to be operating in what appeared to be an entirely satisfactory manner, but the connected machines—and there were many of them, including a large air compressor—evidently were operating much below normal speed. A test of the armature speed proved it to be about right, but it was noticed that the bearings and the pulley were very hot. The comparatively short belt was vertical; also it was very greasy. Operating conditions were much improved by cleaning of the pulleys and the belt, but it became evident that the tension required in order to keep the

belt from slipping was excessive. As changing the location of the motor was impracticable, the only immediate means of relief was to take some of the load off the motor. This was done with entirely satisfactory results.

Brooklyn, N. Y. E. C. PARHAM.

RIVETS HEATED BY MEANS OF ELECTRIC CURRENT

Direct and Indirect Heating Have Both Been Found Suitable—Energy Consumption Is About 20 Kw.-hr. per 100 Lb. of Rivets with Either Method

Two methods of heating rivets electrically are used quite extensively, one in which the rivet itself short-circuits the secondary of a transformer, the other in which granulated carbon short-circuits the secondary and radiates heat to the rivets. About forty heaters of the first type are being used by the American Car & Foundry Company, these having been found very satisfactory when an air hammer is used for riveting, and especially where delays are liable to occur in fitting the material to be riveted, since power is required only when the rivets are being heated. These heaters, depending on their size, will turn out 25 lb. to 250 lb. (11 kg. to 110 kg.) of rivets per hour with a power demand of 7.5 kw. to 30 kw. and an energy consumption of 20 kw.-hr. per 100 lb. (45 kg.) of rivets. The rivets can be heated in thirty seconds.

The chief advantages of the second type of heater are that the rivets can be heated uniformly and without oxidation. The latter is important because it avoids

DIRECT TYPE OF RIVET HEATER IN OPERATION

Each rivet is held by its individual spring mechanism between both ends of the transformer secondary. The transformer is directly back of the rivets.

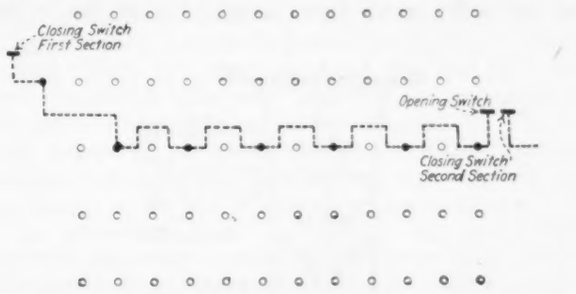
reduction in size of rivets and loose fits and consequently the necessity of removing them. With one of the first heaters of the resistance-furnace type installed at the Ambridge plant of the American Bridge Company, about 200 rivets were turned out per hour at a temperature of 2000 deg. Fahr. (1100 deg. C.) and a power demand of 40 kw No tendency to overheat was noticed and the presence of a reducing atmosphere prevented oxidation and the consequent pitting and wastage of rivets. When this type of furnace is worked to capacity continuously the energy consumption is about 400 kw.-hr. per ton of rivets. Including the furnace and transformer the initial cost is about $100 per kilowatt.

W. S. Johnson of the American Car & Foundry Company developed the direct type of heater and the Electric Furnace Company the indirect type of heater.

WATCHMEN'S PILOT LAMPS SERVE AS ORDINARY UNITS

Alternate Fixtures on Separate Circuit Are Controlled by Two Three-Way Switches—Can Be Used for Emergency Lighting

In order to have light for the watchmen as they go through the factory at night without lighting lamps on the entire floor or installing separate units,



PILOT LAMPS FED FROM INDEPENDENT CIRCUIT DIRECT FROM TRANSFORMER ROOM

the International Motor Company of Plainfield, N. J., has installed in its newest building combined pilot and emergency lamps which serve also for ordinary lighting. This is done by feeding every other lamp, in the center of five rows, from a separate circuit controlled by a three-way switch near the entrance to the floor. The watchmen lights this row of lights on entering and, after walking to the end, lights the next section and turns out the preceding units. The opening switch of the first section and the closing switch of the second are placed side by side.

Inasmuch as these circuits are fed from separate feeders in sets of risers separate from the main lighting circuits, the pilot lamps can be utilized for emergency service. The pilot-lamp circuits also have separate fuse boxes on each floor. On the factory and office floors the main lighting units are fed from circuits in groups of six each. Lockwood, Greene & Company were in charge of the electrical installation.

Hemispherical Distribution Needs Consideration

In determining the proper lamps and reflectors to use and their correct location in industrial plants, it is not nearly so important to know the illumination on the working plane as it is to know the hemispherical distribution, according to Bassett Jones of Myer, Strong & Jones. The value that should usually be known is the intensity of light which comes at an angle of about 45 deg. Therefore units which give a small number of foot-candles illumination on the horizontal plane and a larger number at the 45-deg. angle are usually better than those which have a high intensity vertically under the lamp.

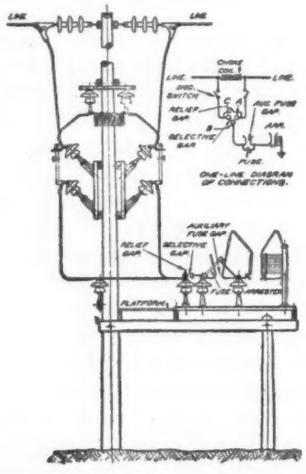
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SURGE ARRESTERS FOR TRANSMISSION LINES

Arrangement of Choke Coil and Lightning Arrester for Protection from Disturbances Coming from Either Direction

Lightning and high-speed power surges are among the most annoying sources of trouble on modern high-tension transmission systems. Small systems with comparatively few miles of metallically interconnected lines do not suffer much from surges, but as the mileage



CIRCUIT AND CONSTRUCTION SCHEME FOR SURGE ARRESTERS

increases the number of outages due to insulation failure increases in faster proportion than the mileage.

Many transmission systems have found it necessary to go to the inconvenience of sectionalizing the high-tension network so as to prevent surges traveling from one point of the system to the other and breaking down insulation at widely separated points. The installation of lightning arresters along the lines will not alleviate the trouble to any marked extent unless choke coils are also installed in the line at the point of lightning-arrester installation. As surges may come from either direction, this necessitates the installation of two arresters at each choke coil to enable draining the line from both sides of the coil.

A method of arranging equipment to drain surges from either direction is illustrated and will be of particular interest to transmission engineers. Line surges from the right-hand side will be reflected to the sphere gap *A*, striking to *B* and thence to the arrester and ground. Surges from the opposite direction will be reflected from sphere gap *C* to *B*, from there to the arrester and ground.

To permit the use of series limit fuses in the arrester circuit and still have protection in case of fuse operation, an auxiliary gap in shunt with the fuse is employed. The connection in the one-line diagram clearly illustrates the various elements of this new protective device.

The above information is contributed by H. W. Young, Delta-Star Electric Company.

BONUSES FOR THE FIREROOM

Standards Set for All Boiler-Room Employees Such that Capable Men Will Earn Bonuses

If a fireman is to become an expert in coal economy, it must be worth his while to learn and worth while for some one higher up to teach him. Rewards for coal saving are paid by the Charles Pfizer Company of Brooklyn, N. Y., according to an ingenious scheme applied by F. S. Jones, works engineer. For the watch engineers a bonus of 10 per cent of their pay is given. conditioned on the maintenance of an evaporation rate of 8.4 lb. of water from and at 212 deg. Fahr. per pound of coal. This requires that their responsibility for the cleanliness of boiler surfaces, inside and out, shall be taken quite seriously, and that each man should see that the fireman on his watch maintains his fires in proper condition. The fireman's bonus in turn depends on maintaining an average CO_2 per cent of 11.6, as shown by analysis of gas drawn continuously during each watch. Coal passers, too, receive a bonus if they keep the firing floor in good order and lose no time. In all cases a man who cannot or will not earn his bonus regularly is not retained.

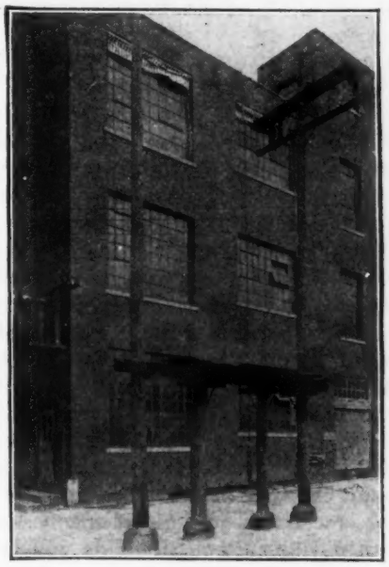
RELOCATION OF TRANSFORMERS AS MEANS OF SAVING SPACE

Industrial Plant Uses Niche of Building to Advantage of Consumer as Well as Power Company to Permit Plant Expansion

Owing to plans for the expansion of the Dodge works of the Link Belt Company of Indianapolis, Ind., it was recently found necessary to relocate a bank of transformers supplying energy from the lines of the Merchants' Heat & Light Company to the factory. The old transformer installation was of the usual two-pole type with two short stub poles for supporting the wooden platform for the transformers. As now installed the transformers are more readily accessible, less secondary copper is required to reach the consumer's outlet, and a neater and better installation has been secured. These advantages were gained in addition to that of vacating the valuable space in the yard and driveway. Moreover, in its present location the bank is in a space where there is remote possibility of disturbance due to plant expansion.

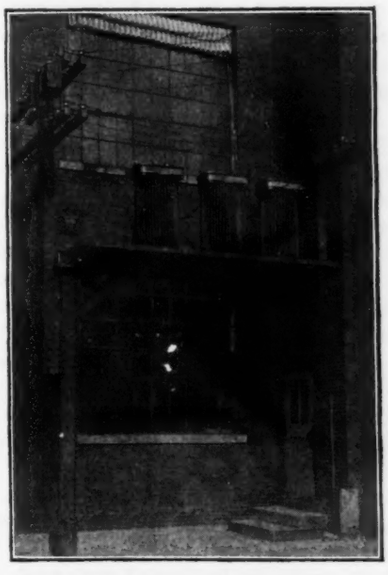
In contrast with the old installation only one supporting member of the structure has a ground footing where formerly four poles were set and guyed. The

vertical supporting member is made up of two 13.25-lb. (6-kg.), 9-in. (23-cm.) ship channels, spaced 18 in. (46 cm.) apart, set well down in concrete, cross-braced with 0.75-in. (19-mm.) by 12-in. (30-cm.) steel plates and also braced against the building wall by one 4-in. (10-cm.), 7.5-lb. (3.3-kg.) I-beam. The cross members to which the 2-in. (5-cm.) by 12-in. (30-cm.) platform



OLD LOCATION OF TRANSFORMERS

material is bolted are made up of two 8-in. (20-cm.), 25-lb. (11.3-kg.) channels spaced 18 in. (46 cm.) apart, one end of which rests on the vertical member, the other extending 18 in. (46 cm.) into one corner of the building wall, allowing a clearance of 14 ft. (4 m.) from the transformer base to ground. Owing to the method of line entrance, it was found necessary to erect 4-in.



OLD AND NEW INDUSTRIAL TRANSFORMER INSTALLATIONS

by 4-in. (10-cm. by 10-cm.) timbers for dead-ending the primary line. These timbers also support the primary fuses, transformer choke coils and primary bus structure.

At present three 75-kva., 60-cycle, 2200/220/110-volt transformers are installed, connected star-delta. The weight of each transformer with oil is approximately 2200 lb. (997 kg.). Ample safety factors have been allowed to take care of additional power in case larger and heavier transformers are found necessary at a future date.

The steel structure was designed and erected under the supervision of Mr. Praed, works engineer Dodge works of Link Belt Company, and approved by the power company's engineering department.

ACCIDENTAL CROSS BETWEEN TWO INDEPENDENT SYSTEMS

Voltmeter Connected Between Outside Wire and Ground Swings Periodically from Zero to Twice Secondary Voltage Owing to Difference of Frequency

In testing out a new installation recently it was found that the voltage to ground from the two outside legs of a three-wire 120-240-volt secondary circuit varied periodically from zero to 240 volts, while the voltage from the neutral to ground remained constantly at 120 volts. The time required for the voltmeter needle to swing from zero to 240 volts and back to zero again varied from two to five seconds.

By means of an exploring-coil outfit for locating accidental grounds the trouble was soon located and was found to be due to a cross between the neutral of the secondary circuit in question and one outside leg of the secondary circuit of another company having distribution lines in the same locality. Both systems operate at 60 cycles, and the voltmeter was simply acting as a synchronoscope, reading zero when the two systems were in synchronism and 240 volts when they were 180 deg. out of phase.

IRON-WIRE TRANSMISSION LINE PROVES DISASTROUS

Short Circuit at Load End of Iron-Wire Line Fails to Blow Fuses Owing to High Reactance of Wires

BY W. C. HESTON
Line Engineer Portland (Ore.) Railway, Light & Power Company

During the war, when copper was so expensive, an 11-kv. line about 5 miles (8 km.) long, consisting of three wires, each composed of six strands of No. 8 bare hard-drawn copper wire (equivalent to about No. 1/0) was replaced with $\frac{5}{16}$-in. (7.7-mm.) galvanized stranded steel guy wire, as the load on the line was light and the copper was needed for a new transmission line to serve shipbuilding plants.

At the end of this line there were two 50-kw. transformers stepping from 11,000 volts to 2300 volts feeding a small town having a load of about 15 kw. During a heavy windstorm a tree fell on the 2300-volt line fed by the above transformers, short-circuiting all three legs. The two 50-kw. transformers were fused for the customary 150 per cent load, but these fuses did not blow under the short circuit on the secondary side of the transformers, because of the high reactance of the steel wire, which rises very rapidly as the current increases.

The result was that two transformers were burned out. The trouble could obviously have been prevented by fusing the transformers for their rated load, or in this case even less, as the load was very light.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

PUBLIC SERVICE COMPANY MAKES ELECTRIC RANGE RATE

Includes Limiting Clause to the Effect that Range Must Be Rated at Over 3000 Watts to Get Service Under the New Rate

In order to satisfy the demand for service for electric cooking in small towns where gas is not available, the Public Service Company of Northern Illinois has filed a new electric cooking rate which became effective May 1. The new rate schedule is 10 cents net per kilowatt-hour for the first 10 kw.-hr. consumed during the month and 3 cents net per kilowatt-hour for all excess consumption during the month. The minimum charge is $24 per year for installations having a total connected load of 6000 watts or less and $4 for each additional 1000 watts or fraction thereof.

The rate is available only to those customers who will install a range having a capacity of 3000 watts or over. Such provision assures the company that the customer will utilize the service for electric cooking purposes. Electricity under the new rate is available for the operation of cookers, toasters, broilers, ovens, kettles, flatirons, water heaters, luminous radiators and other electrical cooking or heating appliances, in addition to the electric range.

The company has already started demonstrations in those small towns where gas is not available, and from the number of orders secured the electric range business appears to be very promising.

GOOD WILL OF CUSTOMERS COUNTS, SAYS S. M. KENNEDY

Declares in Paper Read at Pacific Coast Meeting that Companies Will Be Repaid for Taking Pains to Please the Man in the Street

Central-station companies should go out of their way to win the confidence and respect of their customers, says S. M. Kennedy, of the Southern California Edison Company, in a paper entitled "The Man in the Street," which he read at the third annual convention of the Pacific Coast Section, National Electric Light Association, at Coronado Beach, Cal. Pursuant to a resolution of the convention, the executive committee of the association has since published the paper in pamphlet form.

The utility company is on trial twenty-four hours a day, declares Mr. Kennedy. Unlike other business enterprises, it must be ready to supply energy at all times, and, as Mr. Kennedy puts it: "The jury is in constant session taking cognizance of the evidence which is being given, and no item is overlooked when the time arrives to review, sum up and render a verdict. Hence heads of public utility organizations should study the jurors, in this case their customers, with a view to making as favorable an impression as possible."

The man in the street, says the paper, is a many-sided individual in some respects, but in the main he will be found reasonable, tractable, and not unfriendly. The man in the street has some advantages not possessed by the men on the inside, and the latter can well afford to give attention to him.

"What kind of an impression does your company make on the man in the street?" Mr. Kennedy inquires. The man in the street is greatly impressed with the appearance of the office and the treatment he receives from employees when he comes to pay a bill. If it is an old forbidding office with small windows, high railings, and with the clerks shut off from the customer, the latter will be repulsed. The atmosphere should be attractive and inviting, so that the man in the street feels that he is welcome. An air of openness and above-boardness should be cultivated. This will help to give the customer a feeling of genuine confidence in the company.

The central station should make it possible for the man in the street to learn all that is possible concerning the facts of the production and distribution of electricity, so that he may know what he is paying for. The company is selling an intangible commodity, and the man in the street has difficulty in realizing that he pays only for what he gets. The customer will study conditions and reach his own conclusions concerning the business. If the truth is spread before him for thoughtful inspection, his conclusion is likely to be favorable. If, however, he becomes saturated with misinformation concerning the methods and aims of the central station, then his ideas will be perverted and his attitude prejudiced. He must be shown what is the investment and what constitutes a fair return thereon.

Much of the criticism directed against utility companies might be dispelled or relieved by a broad-minded policy in handling complaints, says Mr. Kennedy. Each complaint should be regarded as an opportunity for acquaintance with the consumer and should be given an individuality by impartial and careful investigation. A complaint is an opportunity to make a friend with the individual who makes it. To satisfy means to hold business that probably was difficult and costly to get, and it also means the keeping of old friends and the making of new ones.

New customers are desirable, but, in Mr. Kennedy's opinion, the development of increased business with existing customers is still more desirable. A central-station plant ought to be loaded twenty-four hours a day. The load curve ought to be a straight line before the electrical consumption of any community has reached the saturation point. For greater business from present customers the company must cultivate the man in the street. The most profitable business is produced by inducing customers to increase the number of uses of

electricity. The time has come when it is "up to" central-station companies to interest themselves more than ever before in the manner and method of using their product on the consumer's premises, so that the greatest possible number of benefits and economies may be secured.

GIVE MORE CAREFUL STUDY TO ELECTROCHEMICAL INDUSTRIES

Closer Relations with American Electrochemical Society Are Fostered by Address of Prof. J. W. Richards Before N. E. L. A. Convention

More careful study of electrochemical industries by central stations and closer relations with the American Electrochemical Society are substantially furthered by the address of Prof. Joseph W. Richards on "The Importance of Electrochemistry" before the recent convention of the National Electric Light Association at Atlantic City. Professor Richards, of Lehigh University and secretary of the American Electrochemical Society, pointed out many opportunities which the electrochemical industries offer to central stations.

E. W. Lloyd, Commonwealth Edison Company of Chicago, who has given close attention to the subject, discussed these opportunities briefly in his remarks at the close of Professor Richards' address. Mr. Lloyd said that in his opinion the association had given too little attention to the subject and that it had not affiliated itself with the American Electrochemical Society to the extent that it should have done. Mr. Lloyd said furthermore that he was sure that it would be very profitable for members of the association to pay more attention to the subject. Mr. Lloyd is convinced that there are a large number of products that can be manufactured by electricity at standard rates now in existence, that there are certain electrochemical products that are marketable at a high price per pound or ton, in the manufacture of which the cost of electricity is not an important factor. For instance, the production of high-grade steels and alloys is accomplished by using so few kilowatts that the cost of electricity is not important.

In the course of his discussion Professor Richards said that he thought that the men in the electrolytic refining industries had not worked out as far as could be done the possibility of running for certain hours by water power. In certain plants it would be possible to operate at less power for, say, four hours daily out of the twenty-four hours.

The case of a very large copper refining plant was cited which, before constructing its own power plant, tried to make arrangements with the local central-station company to secure power on a plan involving reduced consumption at certain times during the day. The arrangement fell through because, said Professor Richards, "they did not quite thoroughly understand each other and did not quite go to the bottom of the proposition, and analyze the problem, and get into their minds exactly the difference which would be caused by the proposed arrangement."

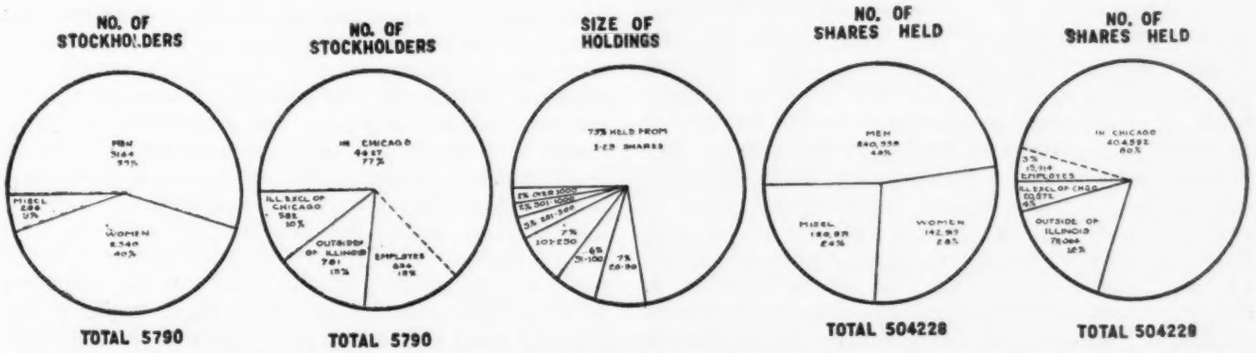
A number of industries were discussed by Professor Richards in which electric power is used and there are large possibilities of development. He described a process for making aluminum which has reduced the cost from about $2.50 a pound to less than 15 cents a pound. "The size of the aluminum industry," he added, "may be indicated by the fact that there is probably 400,000 hp. at work in the United States making aluminum at present, and the chief company which is making aluminum is developing a plant of 400,000 hp. more in eastern Tennessee to double its output."

The most important thing in the metallurgical field now, said Professor Richards, is the invention of the electric heating furnaces. The United States Steel Corporation will be turning out 10,000 to 20,000 tons of electric steel a month in the near future, because it is using the electric furnace to do it. This industry will increase very rapidly. It has increased in the last five years from about thirty concerns in the United States making electric steel to about 250 or more.

"I am forced to admit," said Professor Richards in conclusion," that the electrochemist and the electrometallurgist have not studied out their power problems as they should have done. They have not got together with the central-station men as they should have done. Perhaps there is blame on both sides. I think particularly the electrochemists have not studied out their questions where they could get together with you on the question of intermittent power."

Distribution of Stock of Commonwealth Edison

In a recent address before the new-business and underground-extension groups of the Commonwealth Edison Company Section of the National Electric Light Association Louis A. Ferguson, vice-president of the company, gave some details of the distribution of the capital stock. Chicago people hold 80 per cent of the total shares of the company and constitute 77 per cent of all stockholders. Of the employees 834 are stockholders, and 4254 stockholders own only from one share to twenty-five shares.



COMMONWEALTH EDISON COMPANY STOCK IS OWNED LARGELY BY RESIDENTS IN THE CITY WHERE ITS SERVICE IS RENDERED

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Connection of Valves in Polyphase Systems.—In the usual mode of connecting valves for rectifying polyphase currents, the valves are in operation for only a fraction of the total time. For instance, in a six-phase system each anode, and in consequence each secondary transformer winding, is in operation for only one-sixth of each period. In the method shown in French patent No. 487,789 of Brown, Boveri & Company a method of connection is shown by which the valves and windings are maintained in continuous operation.—*Technical Supplement to Review of Foreign Press*, April 19, 1919. (Abstracted from *Revue Générale de l'Electricité*, March 29, 1919.)

Safe Operating Temperatures for Mica Insulation.—H. D. STEPHENS.—Evidence of the ability of mica to withstand high temperatures is shown from the performance of some of the generators installed at Niagara Falls. These were built in 1895, and in 1913 an opportunity was given to install thermocouples in one of these machines. Temperatures of copper were obtained in a mica-insulated generator that had been in operation for about twenty years. Thermocouples were installed in contact with the copper and in various other locations within the slots. Internal temperatures were obtained for the range of loads through which the generator normally operates. From the operating record of this machine and from the measured temperatures the length of time the generator has operated at different temperatures was found to be as follows:

Length of Service in Hours	Range of Operating Temperature (Based on 35-deg. air)
40,000	120 to 145 deg. C.
13,000	145 to 175 deg. C.
8,200	175 to 210 deg. C.
2,600	210 to 245 deg. C.
100	245 to 285 deg. C.

Since 1912 thermocouples have been installed in practically every large generator of new design and readings have been obtained of internal hot-spot temperatures. In many cases generators that were designed in line with past practice to meet a 50-deg. rise by thermometer were found to have hot-spot temperatures 50 deg. higher than the surface temperature. Tests on twelve 60-cycle turbo-generators ranging in size from 5000 kva. to 20,000 kva. gave average results as follows: (1) Surface coil temperature rise, by thermometer, 22 deg. C.; average coil temperature rise, by resistance, 43 deg. C.; hot-spot coil temperature rise, by thermocouple, 85 deg. C. (2) Similar tests on nine large 60-cycle moderate-speed generators (mainly waterwheel-driven) gave the following average temperature rises: Surface coil temperature rise by thermometer, 45 deg. C.: average coil temperature rise by resistance, 54 deg. C.; hot-spot coil temperature rise by thermocouple, 82 deg. C. From the accumulation of evidence gathered, the author concludes: (1) That large generators insulated with the best and latest types of mica insulation not only can but actually do operate with safety with total internal temperatures up to at least 150 deg. C. (2) That the results obtained by the use of embedded temperature detectors vary widely, and that the manufacturer who is carefully and generally testing with such equipment is best fitted to locate and to specify the type of measuring devices to be employed.—*Electric Journal*, April 1919.

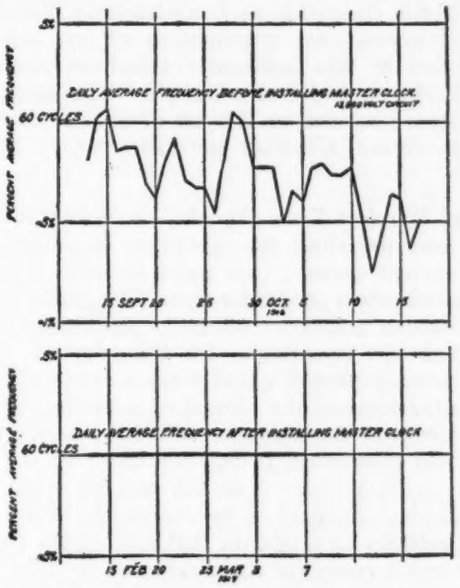
Lamps and Lighting

Performance of Argon-Filled Tungsten Lamps.—H. PECHEUX.—In *La Lumière Electrique* for May 16, 1908, June 24, 1911, and March 20, 1912, the author gave the result of his experiments upon metallic-filament lamps of the older varieties, especially as regards the resistance of the filament to heat and cold. He now takes up the study of the new gas-filled lamps, estimating the influence of overvoltage upon luminous intensity and paying special attention to the variations of the characteristic coefficient of the filament, not only in terms of the nature of the filament but also, for any given filament, in terms of the time during which it is subjected to the current.—*Revue Générale de l'Electricité*, May, 10, 1919.

Generation, Transmission and Distribution

Improvements of the Power Factor as a Consequence of the Unification of Frequencies.—A. CUSMANO.—The problem of the unification of the frequencies of the electric installations in Italy was studied by a committee of the Associazione Elettrotecnica Italiana, which proposed to adopt for the new installations the frequencies already existing in the region. The author considers that this proposal is not always rational, as it would not always furnish the greatest sum of advantages. To demonstrate his thesis, the author calculates the costs of a new plant for a concrete case, adopting first the frequency 42 of the region and afterward the frequency 50 and installing a synchronous frequency changer for the energy transmission between the new and the old plant. The increase of the power factor obtained by the choice of a convenient size for the frequency changer allows of obtaining an economy in the costs of the alternators, transformers and electric line, so that, finally, the installation results in being more economical than if the frequency 42 were adopted. Moreover, as the cost of the apparatus for frequency 50 is less than that for frequency 42, a supplementary economy could be realized in the costs of the individual transformers and motors. Consequently the author advocates the adoption of the frequency 50 for the new plants, which solution, in the case of connection with a line at frequency 42, would reconcile the particular interest of securing economy with the general interest of increasing the power factor.—*Science Abstracts, Section B*, March 1919. (Abstracted from *Elettrotecnica*, Feb. 5, 1919.)

Utilizing the Time Characteristics of Alternating Current.—HENRY E. WARREN.—By the invention of a very small, simple and reliable self-starting synchronous motor, in conjunction with convenient means for regulating the average frequency of an alternating circuit, there has been developed a new field of usefulness for electric power. It is now feasible to drive all kinds of timing devices, such as clocks, graphic-instrument movements, time recorders, etc., directly from the lighting circuits. Remarkable accuracy is obtained, and the amount of care is minimized by the elimination of winding and regulating. The effect of the installation of a master clock is here illustrated. Above is shown varia-


DAILY AVERAGE FREQUENCY BEFORE INSTALLING MASTER CLOCK
60 CYCLES
DAILY AVERAGE FREQUENCY AFTER INSTALLING MASTER CLOCK
60 CYCLES

HOLDING THE FREQUENCY BY TIME CLOCK

tion of frequency to be expected under present conditions; below, that promised by the master-clock scheme. —*Proceedings A. I. E. E.*, May 1, 1919.

Construction Methods Used at Drummondville.—JAMES DICK.—Problems encountered in the damming of the St. Francis River and building a power house to develop about 19,000 hp. are discussed by the author. It is shown that 2900 ft. (880 m.) of cofferdams were required for the construction of an 1890-ft. (580-m.) dam. It is stated that concrete for the dam was delivered over long distances by means of steel V-shaped cars of 1-cu.yd. capacity. These operated at a capacity of 24-in. (60-cm.) gage and were laid on light trestle built along the upstream side of the dam.—*Canadian Engineer*, April 24, 1919.

Operation at Holtwood.—CHARLES H. BROMLEY.—Some results from the operation of the Holtwood plant of the Pennsylvania Water Power Company are given. Wear and corrosion troubles in the link pins, vane pins, reachrod and wrist pins of the double-runner units have been overcome by the use of monel metal for these pins. Micarta bushings are now being tried, and experience so far indicates good results. The large submerged pins, which originally had no lubrication other than that given during periodic overhauling of the turbines, are now lubricated from the turbine-room floor by means of a grease gun from which a separate pipe runs to each pin. These improvements have increased the interval between general overhauling of the units at least threefold.—*Power*, May 13, 1919.

Traction

Narrow-Gage Electric Railways.—During the war a large quantity of material for railways with a gage of 0.6 m. instead of the standard gage of 1 m. was manufactured in France and now awaits a use. This article suggests that it can be employed in serving agricultural railways, forestry exploitations and, generally, in the furtherance of public work, as advocated by L. Esbran in a paper presented before the French Society of Electricians. Mr. Esbran maintains that while the many narrow-gage steam locomotives built for war purposes can be utilized in the ways just mentioned, they cannot be put to any permanent use. Electric locomotives of 0.6-m. gage, on the other hand, lend themselves to intensive traffic both freight and passenger, and he holds that there is a future for narrow-gage railways thus equipped.—*Revue Générale de l'Electricité*, April 19, 1919.

Installations, Systems and Appliances

Improved Form of Granular Carbon Resistance Furnace.—C. H. LOVEJOY.—A granular carbon resistance furnace of the type described in Bulletin 129, United States Bureau of Mines, for the determination of the fusibility of coal ash and softening temperatures, has recently been built with several improvements to facilitate operation and replacement of worn parts. The furnace was built at slight expense from standard fittings, with very little machine-shop work necessary. A cross-section of this furnace is presented in the article and details are explained.—*Chemical and Metallurgical Engineering*, May 15, 1919.

Review of the Propelling Equipment and Operation of the New Mexico.—ESKIL BERG.—Of particular interest are the statements of the contract weight, steam consumption, penalties and price of the equipment and its performance on the trial run. The table presented here gives the water rates attained on two trials, the second after final adjustment of conditions:

	—Water Rate, Lb. per Shaft—Hp.-Hr.			
	Full Speed	19 Knots	15 Knots	10 Knots
No. 1 trial report	12.29	11.926	11.667	14.223
Results indicated by readings of electrical instruments	12.30	11.55	11.35	14.35
Guarantees reduced to trial conditions	11.67	11.03	11.495	15.28
No. 2 trial report*	12.01	12.196	12.482	14.22
Results indicated by readings of electrical instruments	11.58	11.50	11.60	14.35
Schenectady test reduced to trial conditions	11.00	11.08	11.16	14.25
Guarantees reduced to trial conditions	11.31	11.184	11.45	15.28

* Given unofficially before the preparation of the report.

The fuel economy shown by the New Mexico trials, as reported by Commander S. M. Robinson, is 20 per cent better than the turbine-driven Pennsylvania at high speeds and about 30 per cent better at 15 knots.—*General Electric Review*, April, 1919.

Electrochemistry and Batteries

Electric Furnaces.—W. E. MOORE.—It is said that steel can be made electrically with a more satisfactory chemical analysis than by other methods. Even with the same chemical analysis the electrical field will average 15 per cent greater tensile strength or ductility and is more resistant to shock and better able to receive heat treatment. The reason for this is that the steel is more solid, freer from gases and less prone to inclusions of slag oxides. In open-hearth furnaces it is

impracticable to melt down fine turnings in quantity for the reason that the oxidizing flames, which furnish the heat to the furnace, will reduce the metal when in an attenuated form to a mass of oxide before it becomes molten, whereas with the electric furnace it is entirely practicable to melt turnings, which under ordinary market conditions are purchasable at about $10 to $15 per ton lower than the heavy melting grade of steel required in open-hearth practice. Comparing the manufacture of electrical steel to that of crucible steel, the writer states the objections to the crucible process as follows: (A) High cost of pure melting stock, as no refining is practicable; (B) very high labor cost on account of the small heats handled; (C) crucible furnaces are notoriously extravagant in fuel consumption, sometimes using three tons of coal per ton melted; (D) high cost of crucible renewals, often averaging two to four crucibles per ton, melted at a cost of $9 to $11 each, or $18 to $44 per ton for crucible alone. For these reasons the crucible melting shop is rapidly going out of use for castings as well as for tool steels. A comparative cost table presented by the author for wartime operation shows the cost of converter steel to be $57.94 per ton, whereas the cost of electric steel in the ladle is $31.63.—*Journal Engineers' Club of St. Louis*, March-April, 1919.

Iron Alloys for Use in Electric Apparatus.—The Société Anonyme de Fourchambault, Commentry et Decazeville, exhibited at the Lyons Fair a number of special alloys manufactured at its works at Imphy. These included: (1) An alloy specially made for electric resistances; (2) an alloy with a thermo-electric power greater than that of iron with respect to lead. This alloy has high mechanical strength, low thermal conductivity and small resistance-temperature coefficient and is particularly suitable for thermo-junctions and industrial pyrometers. (3) An alloy with magnetic permeability that decreases rapidly with increase of temperature, and suitable for use in electric meters with permanent magnets. (4) An alloy that can acquire strong magnetism and retain it when subjected to demagnetizing actions. This is recommended for the construction of permanent magnets. (5) A non-magnetic alloy, non-oxidizable at ordinary temperatures in fresh or sea water. This alloy is subject to very small wear by friction, is remarkably ductile and does not tire under the action of repeated shocks. It is used greatly in artillery, railways and automobile construction and for the manufacture of springs.—*Technical Supplement to Review of Foreign Press*, April 29, 1919. (Abstracted from *Revue Générale de l'Electricité*, March 22, 1919.)

Units, Measurements and Instruments

Helps on Proper Maintenance of Pyrometers.—A. GEMMELL.—The electric pyrometer should be kept in first-class condition to obtain accurate results. The better the care of the leads, fire-ends, etc., the better the results that can be obtained. The proper handling of leads and fire-ends in practical furnace installations is taken up in this article.—London *Electricity*, April 25, 1919.

Telegraphy, Telephony and Signals

The Valve Tube with Three Electrodes.—C. GUTTON.—A review of the work of the French military radio-telegraphic establishment dealing with the performance of vacuum tubes. New models of three-electrode valve tubes were made for the service. As generators of waves these tubes made possible posts with sustained waves capable of sending messages many hundreds of kilometers. They were a great aid in wireless telephony, permitting airplanes to communicate with the earth and with each other.—*Revue Générale de l'Electricité*, April 26, 1919.

The Telephone Repeater.—In this article may be found a simple and extremely clear explanation of the thermionic valve, together with its application as a telephone repeater.—*Post Office Electrical Engineers' Journal*, April, 1919.

Automatic Operation in Long-Distance Telephony.—C. JANCULESCO.—An examination of the subject as exemplified by the automatic telephone systems of Ohio, Michigan and South Dakota. The adoption for long-distance service in Europe of similar methods is favored.—*Revue Générale de l'Electricité*, April 19, 1919.

Nauen Wireless Time Signals.—B. WANACH.—In the device here described the operation is initiated by a single current pulse. This pulse actuates an electromagnet and sets a pendulum free. The pendulum in its swings causes a disk to rotate in jerks, following the swings of the pendulum. On the edge of the disk projections are provided that make a series of contacts by pressing against the tongue of a spring, and these contacts control the signals. After the series of time signals has been given in one revolution of the disk, a cam on the disk closes a second contact, which causes a second electromagnet to be energized. This electromagnet releases an armature that catches the pendulum and arrests it ready for its release for the first electromagnet at the succeeding time signal.—*Technical Supplement to Review of Foreign Press*, April 29, 1919. (Abstracted from *Zeitschrift für Instrumentenkunde*. January, 1919.)

Miscellaneous

Insulating Materials.— DR. BULTEMANN.—The writer discusses the physical, chemical and electrical properties of fiber insulators—slate and marble, mica, wood (variously impregnated), vulcanite, gutta percha, products of cellulose, bakelite and glass.—London *Electrician*. April 25, 1919.

Community of the Trained Engineer.—The writer deals in some detail with the position of engineers at the present time and the desirability of forming unions to protect their interests. The statement is made that it is now next to impossible for an engineer to move from one firm to a better position with another engaged in similar business. This means that once an engineer has entered the services of a particular firm he is virtually tied to that firm for the remainder of his existence, unless he is prepared to risk taking up work in some other direction. The latter course, however, necessarily means that he must accept lower terms, as accumulated experience is largely sacrificed. Such restrictions do harm in two ways: First, they keep down the level of salaries below the standard which they should attain, thus preventing the inflow of good men into the industry, and, second, they produce a discontented frame of mind. The several lines along which a union of engineers might be formed are discussed at considerable length in this article.—London *Electrician*, April 25, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

FAVORABLE LEGISLATION FOR MISSOURI UTILITIES

Annual Association Meeting Finds Much of Interest in Acts of State Legislature During the Last Year—J. M. Scott Elected President

Nearly every speaker at the thirteenth annual convention of the Missouri Association of Public Utilities at Excelsior Springs, June 5, 6 and 7, mentioned the activity of the Missouri State Legislature during its last session. A law was passed making it a felony to defraud a gas or an electric company. Surveys to locate "jumpers" are in progress in many parts of the state, because under this law electric service thieves can be prosecuted, whereas it was very difficult to secure a conviction under the old law, which made it necessary to show intent to defraud.

Another act passed by the Legislature which was of interest to utilities was the workmen's compensation law. A great variety of House and Senate bills for repeal or restriction of the Public Utilities Commission act were defeated. A full report on this situation was made by J. C. Hall, St. Louis, chairman of the association's legislative committee. President J. H. Van Brunt, St. Joseph, spoke briefly about these bills in his presidential address, but devoted his main attention to municipal ownership and union labor. He cautioned delegates to be on guard against the growth of municipal ownership doctrines, which seem to be spreading quite freely in the near Southwest. He also entreated association members to show the same intense coöperation in utility affairs which unionized labor always exhibits in its efforts to attain its object.

Other speakers at the meetings were: A. V. Wynne, St. Joseph, on "Employees' Morale"; J. B. Hoelz, St. Louis, on "Flow Meters"; L. T. Block, St. Louis, on "Workmen's Compensation and Insurance to Cover Such Risks," and John F. Gilchrist, Chicago, on "Public Utility Securities." F. C. Buffe read a paper by P. J. Kealy, Kansas City, on "One-Man Cars."

Other Branches of Industry Included

One important change was made in the method of operation and scope of the association. Manufacturers, jobbers and dealers now may be active members of the association with all privileges except that of holding elective office. Moreover, one representative of this class of members will sit with the association's executive committee in all its sessions. This change was made to effect close coöperation with manufacturers and to secure the benefit of their experience and opinions in convention discussions.

Officers for the ensuing year were elected as follows: President, J. M. Scott, Kansas City; first vice-president, L. P. Andrews, Sedalia; second vice-president, H. Spoehrer, St. Louis; third vice-president, P. J. Kealy, Kansas City; secretary-treasurer, F. D. Beardslee, St. Louis; committee on public affairs, V. L. Elbert, St. Joseph; executive committee, J. H. Van Brunt, St. Joseph; H. Wurdack, St. Louis; E. H. Algermisson, Montgomery City; W. H. Henby, University City; Mr. McKenzie, Hannibal; E. R. Locke, Mexico, and J. S. Tritle, St. Louis manufacturers' member of executive committee.

LARGER CAPITAL FOR THE KANSAS CITY (MO.) COMPANY

Proposed Increase of $10,000,000 Through Issue of Either Three-Year Notes or Bonds Will Provide for Extensions and Betterments

A reconstruction of finances of the Kansas City (Mo.) Light & Power Company is in progress which will permit an increase in the capitalization of the company by $10,000,000. It is probable that the new money will come either from the issuance of three-year notes or from bonds. In connection with the new financing the name of the company will be changed to the Kansas City Power & Light Company. All of the new capital will be used for extensions and betterments in Kansas City.

INTERCONNECTION OF TWO PENNSYLVANIA COMPANIES

Metropolitan Edison Company of Reading and York Haven Water & Power Company Are to Construct Lines to Exchange Energy

Announcement is made that the Metropolitan Edison Company of Reading, Pa., has signed a contract for an exchange of energy with the York Haven Water & Power Company at York Haven, Pa. The latter company gives service to the town of York and surrounding territory and furnishes wholesale energy to the city of Harrisburg. It also supplies the large steel plant at Steelton.

This new contract of the Metropolitan Edison Company probably will enable the company to dispose of a large amount of energy to the water-power plant as the latter is completely up to its capacity and either must purchase energy from some outside source for all future growth or else develop a new plant. The York Haven company also must have some source of energy for periods when river water is low and the water plant cannot be used to full capacity.

It is estimated that the interconnection of the Metropolitan and York Haven companies involves new construction costing $250,000. In making this connection the Metropolitan company is following its established policy, for it already has connections with several properties, including the Counties Gas & Electric Company at Norristown and the Phoenix Water Power Company at Collegeville.

TO WIDEN KNOWLEDGE OF AMERICAN TECHNICAL PRACTICE

McGraw-Hill Company Bids Godspeed to F. O. Cooke, Who Returns to England to Extend International Distribution of Company's Publications

Members of the staffs of the ten technical and trade journals of the McGraw-Hill Company, Inc., publisher of the ELECTRICAL WORLD, gathered at a dinner at the Manhattan Club, New York City, on Wednesday night to wish godspeed to F. Ormsby Cooke, managing director of the Hill Publishing Company, Ltd., of London, who is returning shortly to England after a brief visit in the United States. Mr. Cooke has been identified for the last nineteen years in London with McGraw-Hill publications and now returns to his native country as the European representative of these publications to widen and enlarge their international distribution and thereby increase abroad the interest in and knowledge of the best in American technical advancement and engineering practice.

The various speakers at the dinner emphasized the growing ties that bind the United States to England and the continent of Europe. Not the least of these ties is that of American engineering practice, which during the war won such a firm foothold in Europe. McGraw-Hill engineering publications are recognizing this new condition and as pioneers are making greater efforts to serve through a widened distribution this international need for information regarding American practice.

"The engineering journal," said James H. McGraw, president of the McGraw-Hill Company, in a crystallization of the thought of the evening, "is a tool. It is just as much an international tool as it is a domestic tool."

Frequent mention was made during the evening of the necessity for American capital taking up foreign securities if the markets of the world are to continue to absorb American merchandise in large volume.

ANNUAL CONVENTION OF THE JOBBERS AT HOT SPRINGS, VA.

Exceptionally Large Number of Delegates from All Sections of the Country in Attendance at This Week's Meeting—Business Transacted

The eleventh annual convention of the Electrical Supply Jobbers' Association was held at Hot Springs, Va., on Tuesday, Wednesday and Thursday of this week. An exceptionally large number of jobbers from all sections of the country were in attendance, and in addition to the general sessions mornings and evenings there were two meetings of the Atlantic Division and one of the Central Division during the week.

It was suggested by the Atlantic Division that manufacturers allow a differential in favor of goods shipped to jobbers' warehouses as against goods shipped directly from the manufacturer to the consumer, inasmuch as the former shipments involve an element of service by the jobber not rendered when merchandise is shipped directly at the convenience of the manufacturer. It was also suggested that price lists be revised so as to obviate the necessity of quoting list plus, as at present, instead of list.

Two set addresses were made at the general sessions of the association, one by William A. Durgin of the Commonwealth Edison Company of Chicago, who gave an interesting illustrated lecture on industrial lighting, and the other by Dr. Frank Buffington Vrooman, whose topic was "Bolsheviks Big and Little."

The jobbers' association indorsed the work of the Bureau of Research and Education about to be started by the National Association of Electrical Contractors and Dealers and recommended that individual jobbers support the movement. The association also adopted resolutions against the repeal of the present daylight-saving act.

Prof. Irving Fisher's paper on the new price revolution, presented before the conference of governors and mayors in Washington early in March, was read by W. E. Robertson of Buffalo for the information of those in attendance, and the present trend of the markets, particularly in iron, cotton and copper, was discussed.

It was decided to hold the next annual meeting of the association, which will be in the spring of 1920, at Del Monte, Cal. Edward W. Rockefellow of the Western Electric Company, New York, and F. M. Bernardin of Kansas City were reëlected members at large, and the board of directors reappointed the present staff.

ACTION ON WATER-POWER LEGISLATION IS DELAYED

Nothing Done in Either Branch of Congress, and Every Effort Will Have to Be Brought to Bear to Secure Passage of Law

Action on the proposed water-power legislation in both branches of Congress has been delayed during the last week. In the House of Representatives those who are interested in urging the passage of water-power legislation have been waiting for the public lands committee to get through with the work it has been doing. In the Senate the committee of five which, as previously reported in the ELECTRICAL WORLD, is in charge of the proposed legislation has not been able to get together because of the complications with respect to the proposed legislation concerning foreign matters.

The indications are that almost all of the attention of both branches of Congress at the present extraordinary session will be devoted to matters concerning foreign affairs, and it is suggested and advised in Washington that those who are interested in the water-power act shall bring every effort to bear to gain the business legislation which the country requires.

The Illinois Commission in Self-Defence

In answer to the many charges made against it the Illinois Public Utilities Commission says: "From Jan. 1, 1914, to Jan. 1, 1918, as a result of reductions in rates made with the approval of the Public Utilities Commission, the sum of $5,825,000 was saved to the people of the state in decreases of public utility rates. During the year 1918, owing to increases in rates caused by war prices, there was a loss in savings to the people in gas, water and heating rates, but there still continued to be a saving in electric rates. In spite of the increased rates for water, gas and heating during 1918 and the latter part of 1917, there still remains a net saving to the people of the state of $5,871,000 due to decreases approved by the commission since Jan. 1, 1914."

Resuscitation from Electric Shock

The ELECTRICAL WORLD publishes as a supplement with this issue a chart giving instructions for resuscitation from electric shock by the prone pressure method as recommended by the National Electric Light Association. This chart is an abbreviation of the booklet of rules for resuscitation from electric shock, as revised by the association and presented at the recent Atlantic City convention by the committee on safety rules and accident prevention, of which W. C. L. Eglin is chairman.

Mr. Eglin, reporting as chairman, called attention to the work of the first Commission on Resuscitation from Electric Shock, organized in 1911. His statement continues:

"The 'Rules for Resuscitation from Electric Shock,' which were based on the findings of this commission and were printed and distributed by the National Electric Light Association, have been widely used and have, judging by the evidence presented, adequately fulfilled the purpose for which they were produced.

"Certain questions respecting the method and the use of artificial respiratory and auxiliary apparatus have, however, arisen since the rules were originally issued in 1912, and it was deemed advisable to organize a third resuscitation commission to review the work accomplished and to make such further recommendations as the commission might consider would be helpful. The study of the proceedings and the application of the resolutions [of the commission] by whom and whenever possible are urged in the interest of life conservation.

"Upon receipt of the proceedings and resolutions of the commission, the sub-committee on accident prevention, consisting of Charles B. Scott, chairman, and Magnus Alexander, R. L. Baker, P. H. Bartlett, H. J. Burton, H. B. Harmer, Wills Maclachlan and W. T. Morrison, was requested to undertake the revision of the rules for resuscitation, which has been done with the thoroughness characteristic of the work of this committee.

"The revision of the rules and also the chart, which consists of an abbreviated form of these rules, has been based on field experience covering a number of years; and while no very radical changes have resulted, changes in detail have been made which, it is felt, will make the operation of the method more effective, and to which the careful attention of instructors and those familiar with the method is directed."

Public utility companies are urged to give frequent practical instructions and demonstrations on the use of these rules and to require superintendents, foremen or others having charge of men to be responsible for the regular practice of the method by all employees. It is further recommended that these practice meetings be held monthly and that a record be kept of the attendance.

New French-American Bank to Promote Trade

Among the directors of the French-American Banking Corporation, a combination of French and American banking interests for the purpose of fostering trade between the two countries, are Harry B. Thayer, president Western Electric Company, Inc., and Owen D. Young, vice-president General Electric Company.

The new corporation is expected to prove a great stimulus to Franco-American trade. The merger has the advantage of bringing the American banks taking part in it into closer touch with French finance than would be possible through the establishment of French branches.

MOVING TO REPEAL THE DAYLIGHT-SAVING LAW

Action in Congress Looking Toward the Enactment of Early Legislation to Restore the Clock to Its Old Position

The interstate and foreign commerce committee of the House was expected to report favorably during the present week on Representative Esch's bill to repeal the daylight-saving law.

The House committee on agriculture was prevailed upon, in reporting the agricultural appropriation bill, to add an amendment to the report on the bill repealing Section 3 of the Calder daylight-saving act, approved March 19, 1918. A number of resolutions were introduced in both branches of Congress attempting to repeal the whole Calder act, but more importance was attached to the attempt to fasten a rider on the agricultural appropriation bill, which it is necessary shall become a law by July 1, because that is the measure in which the farmers of the country who are said to oppose "daylight saving" are interested in many ways.

First newspaper reports stated that the proposed rider was intended to repeal the whole Calder act. Instead the language of the proposed rider is as follows:

"Section 3 of the act entitled 'An act to save daylight and to provide standard time for the United States,' approved March 19, 1918, is hereby repealed, effective at 2 o'clock, ante meridian, of the second Sunday after the approval of this act, when by the retarding of one hour the standard time of each zone shall be returned to, and thereafter be, the mean astronomical time of the degree of longitude governing each zone as defined in Section 1 of said act, approved March 19, 1918."

Section 3 of the Calder act is as follows:

"That at 2 o'clock, ante meridian, of the last Sunday in April of each year the standard time of each zone shall be advanced one hour, and at 2 o'clock, ante meridian, of the last Sunday in September in each year the standard time of each zone shall, by the retarding of one hour, be returned to the mean astronomical time of the degree of longitude governing said zone, so that between the last Sunday in April, at 2 o'clock, ante meridian, and the last Sunday in September, at 2 o'clock. ante meridian, in each year, the standard time in each zone shall be one hour in advance of the mean astronomical time of the degree of longitude governing each zone respectively."

Section 1 of the Calder act creates zones; section 2 requires that standard time shall govern the movement of all common carriers, and section 4 names the zones, the first as the Eastern, etc.

When the agricultural appropriation bill was reported to the House a storm of protest arose and champions on both sides came to the front. The rider amendment was ruled out on a point of order, and one of the other twenty-eight bills to repeal the daylight-saving law was considered by the interstate and foreign commerce committee.

Senator Calder is preparing for a great fight, when the agricultural appropriation bill reaches the Senate, to save the legislation of last year which bears his name and which was almost repealed at the last session of Congress, under circumstances similar to the present, when the proposed repeal was attached to the agricultural bill as a rider and when the agricultural bill failed in the filibuster against the President's foreign policies

Telegraph Battalion Returns Colors

Major L. W. Abbott of the 401st Telegraph Battalion, A. E. F., is here shown returning the colors to President M. B. Jones of the New England Telephone & Telegraph Company, at the Boston review held on May 28. Standing next to President Jones is W. R. Driver, Jr., who is general manager of the company, and next to him is Vice-president E. W. Lingley.

MUNICIPAL PLANT IS TO EXTEND AT ST. JOSEPH, MO.

Statement of Conditions Under Which Voters Decided to Enlarge Facilities of Competitor Station—Company to Spend $1,000,000

Voters of St. Joseph, Mo., have authorized the issue of $500,000 bonds to finance additions to the municipal electric plant. This plant for years has provided energy for city street lighting, and the plan is to extend it to furnish commercial electric service.

Several matters have a bearing on this situation and they were described to the ELECTRICAL WORLD as follows by an observer of the recent developments in St. Joseph:

The issue of bonds for extension of the municipal plant was approved by voters in connection with issues for several other purposes which made a very popular appeal to voters, such as for a city hospital, new city hall, sewer and park improvements, etc. Five issues of bonds for these purposes were before the voters on the same day and the slogan of their advocates was "Carry all bonds."

Advocates of the issue of $500,000 bonds for the extension of the municipal electric plant promised an amount of service which it is estimated could not be given for an investment at current costs of less than $1,000,000 even if the money should be spent efficiently.

The plant now existing is used to supply energy for the arc-lighting street system, and the proposed enlargement of service will mean an extensive outlay for station and distribution purposes.

The local private company had trouble last winter which arose from failure of the city water supply. In the emergency the company had to get its water from a temporary source. This led to troubles with the boiler-feed pump and boilers. There was curtailment of the power supply for about ten days, but the company gave partial service during most of this period. To increase its facilities the company is spending practically $1,000,000 this year, adding 10,000 kw. to its generating capacity.

HOLYOKE MUNICIPAL PLANT MAY PURCHASE ENERGY

Massachusetts Municipal Plant Considering Contract with Turners Falls Company Which Means Estimated Saving of $1,000,000

The municipal electric plant at Holyoke, Mass., operated by the city since 1902, has reached a point where the purchase of energy from the Turners Falls Power & Electric Company is being seriously considered as the best means of meeting future demands upon the station. In the past sixteen years the number of customers has increased from 273 to 7510 and the energy output has risen from 1,286,790 kw.-hr. to 20,699,000 kw.-hr. The population of the city is now about 75,000.

It appears that if the present policy of producing energy locally is to be continued, a large outlay will be required in the near future for the construction of a new station, owing to limitations of the present site and the inadequacy of the condensing water supply during the period of annual shut-down of the power canals in the city and also at times when the Connecticut River is low. At such times it has become necessary to discontinue service to some of the largest customers

In a letter to the Mayor and Aldermen dated May 26 John J. Kirkpatrick, manager of the gas and electric department, points out that of a total of thirty-nine municipal plants in Massachusetts twenty-nine are purchasing energy and this proportion is steadily increasing. While the output has increased 50.5 per cent since 1915, the cost of coal has risen 232 per cent, or from $62,000 to $206,000.

The Turners Falls company has offered to supply energy at a price which it is estimated will save the city more than $50,000 per year for the first five years and nearly $100,000 per year for ten years. These rates range in base from 1.2 cent to 0.8 cent per kilowatt-hour, with further adjustment varying with the cost of coal at the Hampden steam plant of the Turners Falls company at Chicopee Junction, Mass. The coal differential includes an adjustment providing for increase as the average cost of coal exceeds $5 per gross ton between July 1 and Dec. 31 of any year, with corresponding reductions below $4.

S. H. Mildram, consulting engineer and accountant, Boston, has prepared a report on the cost of manufacture versus purchase, which was to be discussed Wednesday night at a hearing under the auspices of the Holyoke Chamber of Commerce looking toward favorable consideration of the Power & Electric company's proposal.

In his letter of transmittal Manager Kirkpatrick states that the present proposal, in addition to the apparent advantages offered, is in conformity with the policy of consolidation and conservation of the coal supply which is being advocated so strongly by the national government, and that the proposition is transmitted "with an absolute knowledge that there is no central station in Massachusetts purchasing guaranteed power under more favorable terms." It is not intended to abandon the policy of municipal lighting if the proposal of the Turners Falls company is accepted.

EXTENSION FOR THE NEW ENGLAND POWER SYSTEM

Hydroelectric Station at Vernon, Vt., to Be Enlarged by the Addition of Two 6000-Kva. Generating Units—Other Improvements

The New England Power Company is planning to enlarge its hydroelectric station on the Connecticut River at Vernon, Vt., by the addition of two 6000-kva. generating units with auxiliary equipment. A step-up transformer installation of 12,000 kva. will be required and various outdoor substation material. The new units will operate under a head of from 30 ft. to 35 ft. (9 m. to 10 m.) and will raise the total generating capacity of the plant to about 30,000 kw. The generators will deliver energy at 2300 volts to the transformer banks, whence it will be supplied at about 70,000 volts to the transmission system of the company. The Uxbridge (Mass.) steam plant of the company is also being enlarged at this time by the addition of a 10,000-kva. unit. Within a few weeks it is expected that the interchange of energy with the Eastern Connecticut Power Company's new steam plant near Norwich will be regularly established.

Field work is under way in connection with the 66,000-volt, 15,000-kw. transmission tie line between the New England and Boston Edison systems, final difficulties relative to rights-of-way having been determined by a recent favorable decision of the Massachusetts Gas and Electric Light Commission.

MASSACHUSETTS SUMMER RATE 35 CENTS PER KILOWATT-HOUR

Increased Seasonal Rates for Vineyard Lighting Company Approved by Commission on Showing of Higher Cost of Operation

The Vineyard Lighting Company, Oak Bluffs, Mass., has been authorized by the Gas and Electric Light Commission to increase its summer metered rate for electricity from 25 to 35 cents per kilowatt-hour.

In 1916 the company was before the board on a rate complaint. The questions then at issue related chiefly to the right of its customers to a meter rate in place of a system of rates based upon connected load. An examination by the board disclosed that none of the company's investment could be dispensed with if no electricity was sold during the winter months. The board concluded that under the circumstances this method of charging was justified but recommended certain changes in its application and also, in addition to its other rates, metered service for churches, hotels, stores, shops, saloons, bowling alleys and places of amusement other than motion-picture houses, and to all other customers for heating and cooking devices who have installed a special circuit for such service, at a price of 25 cents per kilowatt-hour with a 5 per cent prompt payment discount during June, July, August and September and a discount of 40 per cent during the rest of the year.

Since that decision the company has voluntarily extended the meter service somewhat and has made some slight modifications in its other rates. During the following season the financial showing of the company improved, but thereafter the increase in expenses due to war conditions rapidly exceeded the increase in revenue. Last year the company was unable to earn its interest charges. The board is satisfied that the proposed increase is justified. The company has also raised the price of 40-cp. street lights 35 cents per month each.

In its brief the company stated that since 1911 its investment has increased 84 per cent; taxes, 680 per cent; output, 170 per cent, and number of customers, 52 per cent. Street-lighting prices for 40-cp. lamps decreased from $1.50 to $1.40 per month until the present advance.

AMERICAN ENGINEERING STANDARDS ASSOCIATION

Correct Statement of Function of the Proposed Organization Shows that It Is to Receive and Pass Upon Recommendations

In last week's issue of the ELECTRICAL WORLD, page 1233, a statement regarding the scope of the proposed American Engineering Standards Association was published. The association reports an error in the statement of the objects of the proposed organization. Section 3 should read:

"To *receive* and pass upon recommendations for standards," etc.,

and not, as given in the original statement:

"To revise and pass upon recommendations for standards," etc.

Rotary Club Inspects Power Plant

When this Rotary Club gathering had lunch at the Miller's Ford power plant of the Dayton (Ohio) Power & Light Company a few weeks ago O. H. Hutchings, associate general manager of the Dayton company, told the guests these facts: "Construction work started Aug. 1, 1916. Placed in regular operation March, 1918. Ultimate capacity, 150,000 hp. Approximately one mile of railroad side tracks. Company owns locomotive for shifting coal cars, etc. Company now serves forty-six cities, towns and villages. Company now serves in excess of 29,000 customers. Coal burned during 1918, 160,600 tons. Cost of coal for year 1918, $725,790.55, or an average cost of $4.52 per ton delivered. Maximum load during 1918, 37,000 hp. Output during 1918, approximately 100,000,000 kw.-hr."

ENGLAND'S PLANS FOR SUPPLYING ELECTRICITY

Outline of Remaining Provisions of Government Bill to Develop and Unify Sources of Supply in the British Isles

This is the conclusion of the abstract of the government bill now pending in the House of Commons, the preceding provisions of which were described in last week's issue of the ELECTRICAL WORLD.

As the provisions of the bill indicate, it is proposed to insure development and conservation of the sources of electric power supply. American companies will be interested in the program of the English government as it is disclosed in the enabling measures given below:

A district board before incurring any capital expenditure above such amount as the Electricity Commissioners may prescribe shall submit for approval to the commissioners such details with respect to the proposed expenditure as the commissioners may require.

FINANCING BY THE TREASURY

It shall be lawful for the Board of Trade after consultation with the commissioners at any time before the establishment of a district board for any area, and for two years thereafter, to construct any generating station, main transmission line or other works and exercise any other powers which a district board can; but nothing in this provision shall be construed as vesting in the Board of Trade any station or line which under this act becomes vested in the district board. The Treasury may issue to the Board of Trade out of the consolidated fund of the United Kingdom any sums not exceeding £20,000,000 required for the construction of any such works or acquisition of land or for working capital for such works on such terms and conditions as the Treasury may think fit. At the end of two years after establishment of a district board or at any earlier time agreed on between the Board of Trade and the district board any generating station, main transmission lines and other works, and any land acquired for the purpose thereof by the Board of Trade under this section situated within the area of the district board, shall vest in that board subject to payment by the district board to the Board of Trade of such sum as may be certified by the Treasury to be sufficient to repay the advances made to the Board of Trade. The prices fixed by the Board of Trade for electricity supplied by it from generating stations established under this section shall be such that receipts will cover expenditure on income account (including interest and sinking fund charges) with such margin as the board thinks fit.

During the period between the passing of this act and the establishment of a district board in any area any two or more of the authorized undertakers within the locality may with the approval of the commissioners, and if so required by the commissioners shall, enter into arrangements for mutual assistance on all or any of the following: (a) The giving and taking of a supply of electricity and distribution thereof; (b) management and working of the generating stations or any part of the undertakings of the undertakers; (c) the provision of capital for carrying into effect and the appropriation and division of receipts under any such arrangement; (d) any matters connected with any of these purchases. The arrangement shall be on such conditions as may be agreed, or if made in pursuance of a requirement by the commissioners on such terms as in default of agreement may be settled by the commissioners.

There shall be transferred to the commissioners the powers of the Local Government Board, the Secretary for Scotland and the London County Council with respect to the sanctioning of borrowing by local authorities under the electric lighting acts, etc. Where consent of the Board of Trade is obtained to the placing of any electric line above ground consent of the local authority shall not be required.

A district board or any authorized undertakers may place any line below ground across any and above ground across any land other than land laid out as building land or land so situated that this would affect the amenity of any dwelling house in cases where the placing of such lines above ground is otherwise lawful. Provided that before placing any such line across any land the board or undertakers shall serve on the owner and occupier notice of their intention, and if within twenty-one days after service the owner and occupier fail to give their consent or attach to their consent any conditions to which the board or the undertakers object it shall not be lawful to place the line across that land without consent of the Board of Trade.

A district board and any local authority authorized by special act or order to supply electricity may provide, let for hire and in respect thereof may connect, repair, maintain and remove (but shall not, unless expressly authorized by the special act, manufacture or sell) electric lines, fittings, apparatus and appliances for lighting, heating and motive power and for all other purposes for which electricity may be used and may take such remuneration and make such conditions as may be agreed upon.

Prices charged by a district board for electricity shall be fixed by the board subject to the approval of the commissioners, and shall be such that receipts will be sufficient to cover expenditure on income account (including interest and sinking fund), with such margin as the commissioners may allow. In addition to any provisions contained in any special act or order limiting prices to be charged by authorized undertakers the commissioners may regulate such prices so that the benefit of any reduction in the cost of electricity or the capital employed in production attributable to provision of this act shall inure to consumers.

Commissioners may require any authorized undertakers to amend or alter the type of current, frequency or pressure.

Anything which under the electric lighting acts may be effected by a provisional order confirmed by Parliament may be effected by a special order made by the commissioners and confirmed by the Board of Trade under provisions of this act, and any provisional order made under the electric lighting acts and confirmed by Parliament may be amended or revoked by a special order under this act.

It shall be the duty of district boards and authorized undertakers to furnish to the commissioners, at such times and in such forms as the commissioners may direct, accounts, statistics and returns.

Every district board shall establish a fund for receipts and payments, and shall submit annually to the commissioners such statement of income and expenditure on revenue account as the commissioners require. Accounts of every district board and their officers shall be audited by auditors appointed by the commissioners. Every district board shall make annually to the commissioners a report of proceedings during the year.

BORROWING BY DISTRICT BOARD

For payment of the purchase price of any generating station or main transmission lines vested in or acquired by a district board under this act or of any undertaking or part thereof which it is authorized to acquire under this act (except where the purchase price is payable by an annuity), or for any other payment for any permanent work or other thing which the board is authorized to do, the cost of which ought in the opinion of the commissioners to spread over a term of years (including interest on money borrowed for capital expenditure while the expenditure remains unremunerative), and during the first three years after establishment of the board for providing working capital, a district board may with consent of the commissioners borrow money in such manner and subject to such provisions as to repayment as the commissioners may prescribe. Money borrowed under this section and interest thereon may be charged on the undertaking and revenues of the district board or on any specific property forming part of the undertaking and shall be repaid within such period as the commissioners may determine. The commissioners may enable a district board to raise money and authorize it to issue stock. Such stock and interest thereon shall be charged on the undertaking and all revenues of the district board. Subject to this act, any stock created

by a district board under this act shall be issued, dealt with and redeemed according to regulations made by the commissioners.

Authorized undertakers whose area of supply is wholly or partly within the district of a district board and any authority, company or person receiving electricity from the board and the council of any county or borough or county district wholly or partly within the district of the board shall have power (a) to lend any money to the district board which the board is authorized to borrow, (b) to subscribe for any securities issued by the board for raising such money, (c) to guarantee or join in guaranteeing interest on money borrowed by the board, (d) to give financial assistance in any other form to the board; provided that in the case of the council of a county or borough or county district, whether or not the council is an authorized undertaker or receives electricity from the board, such powers shall not be exercised without consent of the Local Government Board. The raising of money for lending or subscribing for securities shall be a purpose for which the council may borrow, and money so borrowed shall not be reckoned as part of the debt of the council or any limitation on borrowing under enactments relating to borrowing. Any company, association or body of persons may exercise any such power, notwithstanding anything contained in any act, order or instrument by which it is constituted or regulated, and may apply any of its funds for lending such money. Authorized undertakers may exercise such powers notwithstanding anything in Section 3 of the schedule to the electric lighting (clauses) act, 1899.

The commissioners may lend on such terms as subject to approval of the Treasury they think fit to a district board or any authorized undertakers any money not exceeding £25,000,000 which the board or undertakers are authorized to borrow if the commissioners are satisfied that the board or undertakers cannot otherwise raise the money on reasonable terms. Any sums required for such advances shall be taken out of a special fund under charge of the commissioners, to be called the electricity loans fund. For raising money for this fund the commissioners may issue electricity stock bearing interest at such rate as they with consent of the Treasury determine. Interest on electricity stock shall be charged on the electricity loans fund, and the Treasury may guarantee on such terms as it thinks fit payment of such interest.

Annual Estimates

The commissioners at the beginning of each financial year shall prepare an estimate of their receipts and expenditures, other than on account of loans, under the preceding section during the year and submit it for approval by the Board of Trade. The commissioners shall apportion the amount by which the estimated expenses so approved exceed estimated receipts so approved among the several district boards in proportion to their gross receipts in the preceding year, and every such district board shall, on demand from the commissioners, pay to them the sum apportioned. Provided that during the first five years after passage of this act the amount of such excess shall be paid out of money provided by Parliament, but such payments shall be treated as advances and shall be repaid with such rate of interest as the Treasury may fix by the commissioners in equal annual installments in the next three succeeding years. Sums received by the commissioners shall be paid into a separate fund out of which salaries, remuneration, pensions and gratuities of the commissioners shall be paid.

Section 4 of the conspiracy and protection of property act of 1875 (which relates to breaches of contract by persons employed in supply of gas and water) shall extend to persons employed by a district board for any authorized undertakings.

Where under this act a district board is authorized to enter into an agreement with authorized undertakers or any other authority, company or person for any purpose it shall be lawful for those undertakers, authority, company or person to carry into effect such agreement or as the case may be to act on behalf of the board. Where a local authority as authorized undertaker enters into an agreement with a district board or any other authorized undertaker in pursuance of this act, any expenses incurred by the local authority in carrying the agreement into effect shall be deemed to be expenses incurred under the electric lighting acts and the provisions of Sections 7 and 8 of the electric lighting act, 1882, shall apply accordingly. Where by this act an order may be made conferring on a district board or authorized undertakers necessary powers for carrying into effect an agreement entered into by them under this act, and among the powers to be conferred by the order are powers of breaking up streets, railways and tramways other than such as can be broken up under any order or special act relating to the district board or undertakers, the order shall be a special order and shall apply the provisions of the electric lighting acts and the electric lighting (clauses) act, 1899, relating to breaking up of streets, railways and tramways.

The commissioners may hold such inquiries as they consider desirable for purposes of this act.

The Board of Trade and commissioners may respectively make rules in relation to applications and other proceedings before them under this act and to payments made in respect thereof.

A special order made under this act by the commissioners shall not have effect until confirmed by the Board of Trade. Sections 80 and 81 of the factory and workshop act, 1901, relating to the making of regulations under that act as set out in a schedule to this act shall apply to the confirmation of special orders under this act. Before any special order comes into force it shall be laid before each house of Parliament for not less than thirty days during which that house is sitting.

Subject to modifications the act applies to Scotland and Ireland.

Ministry of Ways and Communications

If a ministry of ways and communications is established by an act of the present session of Parliament, all powers and duties of the Board of Trade under this act and the electric lighting acts and any order or special act relating to the supply of electricity shall from such date as His Majesty in Council may fix be transferred to this ministry, and accordingly references to the Board of Trade in such acts and orders shall be construed as references to the ministry.

Take It Back!

"HERE'S YOUR STUFF."

From New York World.

SCHEDULE OF MEETINGS OF ASSOCIATED MANUFACTURERS

Sessions on June 16 to 18 at New London, Conn., Include Two General Evening Meetings in Addition to the Gatherings of Section Members

A revised schedule of section meetings of the Associated Manufacturers of Electrical Supplies, to be held at the Hotel Griswold, New London, Conn., on June 16 to 18, has been issued by Charles E. Dustin, the general secretary.

In addition to the meetings of sections, two general meetings will be held, on the evenings of June 16 and 17. At the Monday evening meeting the international trade committee will have part of the program, and it is expected that other matters of general interest to the members will also be considered. On Tuesday evening a general history of the development of the submarine both here and abroad will be presented. This was one of the most closely guarded developments of the war, and the large part filled by electrical apparatus and supplies in the submarine make the subject of great interest to the manufacturers.

The schedule of meetings is as follows:

Monday, June 16.—Fuse Section; Outlet-Box Section; Industrial and Street-Lighting Fixture Section; Air-Circuit-Breaker Section; international trade committee; general association meeting in the evening for all members.

Tuesday, June 17.—Signaling Apparatus Section; Heating Appliance Section; Electrical Porcelain Section; Molded or Formed Insulation Section; Rigid-Conduit Section; Non-Metallic-Conduit Section; Armored-Conductor and Metallic Flexible-Conduit Section; Lamp Receptacle and Socket Section; Attachment-Plug Section; Snap-Switch Section; meeting of board of governors; entertainment meeting in the evening for all members.

Wednesday, June 18.—Knife-Switch Section; Panelboard and Switchboard Section; Line-Material Section; Wire and Cable Section.

PROGRAM FOR MEETING OF THE ELECTRIC CREDIT ASSOCIATION

Twentieth Annual Convention at Cincinnati This Week Covers Discussion on Many Questions Important to the Industry

The National Electric Credit Association held its twentieth annual convention at the Hotel Gibson, Cincinnati, Ohio, beginning on Friday, June 13, and extending through Saturday, June 14. The program provided for discussion of a wide variety of topics connected with credit management.

According to the tentative program, Friday morning was given up to registration, greeting by President Hillis, reports of the board of managers, of the secretary-treasurer and of committees. A luncheon followed, at which W. C. Culkins was announced to talk on "Public Utilities."

At the Friday afternoon session it was planned to take up various matters affecting the bylaws and general affairs of the association.

The reading of papers will take up Saturday morning. The program provides for papers and discussion on "Trade Acceptance Experiences—Details of Accounting, etc.," leader C. W. Dupius, Citizens' National Bank, Cincinnati; "Consignment Credits and Lamp Agents," T. K. Quinn, National Lamp Works, Cleveland; "Use of Forms—Experiences, Perplexities, Results," informal discussion from floor; "Moral Risk and Credit Interchange—Luncheon Clubs," by representatives of local associations, leader V. G. Fullman, Pittsburgh; "Handling of an Account—Analysis of Credit Information and Decision," leaders B. S. Berlin, Philadelphia, and J. S. Woodford, Pittsburgh; "Following Accounts—Approved Forms of Correspondence in Connection Therewith," leaders L. M. Creighton, Philadelphia, and C. E. Showalter, Pittsburgh; "Coördination Between Sales and Credit Departments," by representatives of both; "Impressions Gleaned from the Twenty-fourth Convention of the National Association of Credit Men," E. W. Shepard.

A feature of the Saturday afternoon session will be a question box.

COMPLICATIONS IN THE LOS ANGELES ELECTION

Vote Shows Total in Favor of Issue of $13,500,000 Bonds, but Contest in Courts Is Likely Because of Confusion Over Blank Ballots

As stated briefly in last week's issue of the ELECTRICAL WORLD, on June 3 a special election was held in the city of Los Angeles for the purpose of authorizing an issue of $13,500,000 in power bonds. The result of the election was that there was cast a vote of 46,490 for the bonds and 21,143 against. The vote for the bonds obtained the necessary two-thirds of the total, with a margin of 1400 votes to spare

At the same election the city of Los Angeles was authorized by the voters to sell power to other corporations doing business outside of the city.

Of the total amount of the proposed bond issue of $13,500,000, approximately $11,000,000 will be paid for the distributing system of the Southern California Edison Company within the city of Los Angeles and the remaining $2,500,000 will be used in connection with the development of the second unit of hydroelectric power on the Los Angeles aqueduct system.

That the election will be contested there seems to be little doubt, because of confusion resulting from the attempt to hold a special election for voting bonds to purchase the local electric distributing system at the same time and with the same election arrangements as the regular municipal election. This confusion may necessitate the holding of the bond election over again at a later date. Those who opposed the bonds insist that for their ratification two-thirds of the entire number of electors voting in the bond election must have voted for them. Those favoring the bonds hold it was only necessary that twice as many votes should have been cast for them as against them.

The main point is the question of the disposition of the blank ballots voted—that is, whether a blank ballot can be counted as voted. The bonds received a two-thirds majority if only those voters are counted as voting who marked their ballots, but it seems that the bonds did not receive a two-thirds majority of the actual number of ballots deposited in the boxes. The number of blank ballots is estimated at 5000. If there were only half that number and the courts hold they must be counted as "voted," the bonds failed to carry. The proponents of the bond issue have possession of the city administration, so it will be for the taxpayers who were opposing the bonds to contest the election.

Other points are raised by those opposing the bonds, but they appear to be technicalities that the courts would probably brush aside.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

New York Electrical Society Elects Officers.—Edwin B. Katte is the new president of the New York Electrical Society, and George H. Guy is the re-elected secretary.

Electric Club of Chicago.—Major Ainslie A. Gray was the speaker at the club's meeting of May 29, reviewing the work of the Ordnance Department of the United States Army in the war. Major D. J. O'Connor was to speak at the last luncheon of the season at the Hotel Sherman, June 12.

A. S. M. E. to Visit Detroit Edison Plant.—As a part of the program for its spring meeting, which is to be held in Detroit, Mich., from June 16 to 19, a trip to the Connors Creek plant of the Detroit Edison Company is being planned by the American Society of Mechanical Engineers for June 18.

N. E. L. A., Philadelphia Electric Company Section.—Joseph B. McCall, president of the Philadelphia Electric Company, addressed a recent meeting of this section, reveiwing the work of the company and the section. H. Carl Albrecht is the new president of the section and John J. Reily is secretary.

Joint Session N.E.L.A., Iowa Section, and Iowa Electric Railway Association.—The Iowa Section of the National Electric Light Association is to hold a joint session with the Iowa Electric Railway Association on June 18 at Colfax, Iowa. Two addresses are to be made—one by William G. Raymond, dean of the engineering department, State University of Iowa, on "The Iowa State Board of Conciliation, Its Work and Possibilities," and the other by William Chamberlain, general counsel United Light & Railways Company, on "Rate Litigation in Iowa." The program for the Iowa N. E. L. A. Section was published in the ELECTRICAL WORLD of May 24.

Society for the Promotion of Engineering Education.—The annual meeting of this society is to be held on June 25-28 at the Johns Hopkins University, Baltimore, Md. Each half day will be devoted to a special topic, the first session to the Mann report of the joint committee on engineering education, the second to the effect of the war on engineering education, the third to military training in engineering schools, the fourth to the work of the society, and the sixth to a symposium on changes in courses. A number of papers and addresses will be given on the final program, as, for instance, an address by Ira N. Hollis, president of Worcester Polytechnic Institute, on engineering colleges and their administration.

Electrical Men Meet in Portland, Ore.—To stimulate interest in the various branches of the industry a meeting of electrical jobbers, contractors, dealers, central-station men and manufacturers was held on May 21 and 22 in Portland, Ore.

N. E. L. A. Connecticut Get-Together Club Outing.—The Connecticut Get-Together Club of the National Electric Light Association will hold its sixth annual outing at Double Beach, Conn., on June 21. J. T. Hessel, 36 Crown Street, New Haven, is issuing the tickets.

Tri-State Water and Light Association of the Carolinas and Georgia.—Among the addresses to be given at the association convention, which will be held in Greenwood, S. C., from June 17 to 19, are "Algal Growths," by Dr. Francis L. Parker; "Electric Cooking," by George T. Barrett; "Electrical," by W. Rawson Collier, and "A 13,000,000-Gal. Motor-Driven Centrifugal Pumping Plant," by Fred C. Wyse.

Joint Meeting in Chicago.—On May 26 a joint meeting was held by the Chicago Sections of the American Institute of Electrical Engineers and the Association of Iron and Steel Electrical Engineers and the Electrical Engineering and Gas Engineering Sections of the Western Society of Engineers. Two papers were presented. The first, by J. C. Wilson, assistant chief engineer of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., was entitled "Measuring Gas Electrically." The other was by B. E. Fernow, also of the above company, and was called "Lifting-Magnet Operation."

Engineering Education Conference Called by United States Bureau of Education.—At a public conference under the auspices of the United States Bureau of Education to take place in the Willard Hotel, Washington, D. C., these topics will be discussed: Business training for engineers, engineering training for commercial enterprises, significance of the war experience for engineering education, and training of the engineer for overseas engineering projects. A number of business men, public officials and educators have accepted invitations to take part in the proceedings of the conference.

American Institute of Electrical Engineers

St. Louis Chapter.—At the May 28 meeting H. Weichsel, chief designing engineer Wagner Electric Company, gave a short talk on measuring insulation resistance of electrical apparatus, and A. S. Langsdorf, dean of the School of Engineering and Architecture, Washington University, spoke briefly on "Circulating Currents of Direct-Current Armatures," "V-Curves of Synchronous Motors" and "Phase Relation of Interconnected Polyphase Systems."

Lynn Section.—Col. J. M. Andrews, 105th Infantry, 27th Division, A. E. F., gave a talk on experiences with his command in France at a recent meeting.

Denver Section.—The section's annual meeting took place on May 17, and H. S. Evans was elected chairman while R. B. Bonney was chosen secretary-treasurer. Dr. Albert C. Crehore addressed the meeting on "Progress in Atomic Theory."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

San Diego Company's Rates Increased.—Rates of the San Diego Consolidated Gas & Electric Company are increased approximately 10 per cent by a recent decision of the Railroad Commission of California. This amounts to a general revision of the company's rates, effective as of May 1.

Rate Increases in Illinois.—Rate increases have been authorized by the Illinois Public Utilities Commission for the Mount Carmel Public Utility & Service Company and the Canton Gas & Electric Company, and it has entered an order continuing in effect temporarily increased rates previously granted for the Lincoln Water & Light Company.

Service Held Inadequate and Rate Increase Denied.—In a case affecting the Osceola Light & Water Company the Missouri Public Service Commission had before it a complaint as to inadequate service and a demand by the company for an increase in rates in order to enable it to render satisfactory service. The rate increase was denied for the present and the company was ordered to make repairs necessary to put its plant and system in proper operating condition. In part the commission says: "Both the electric and water rates are as a whole as high as are found in most cities of this size in the State of Missouri, and since the plant appears to be operated in an inefficient manner the defendant will be denied any increased rates at the present time, but will be required to make all necessary and needed repairs to its existing water plant, including the installation of some form of reservoir, standpipe or water tower, and to make all necessary and needed repairs to its existing electric system to enable it to give sufficient and satisfactory service."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Northern States Managers Meet.—Managers of the properties of the Northern States Power Company met with the general officers and executives in a two-day business conference at Minneapolis, May 15 and 16. A feature of the program was a paper by H. E. Young, sales manager, on the systematic efforts necessary to build up and maintain public good will.

Middle West Utilities Financing.—The Middle West Utilities Company is offering, through A. B. Leach & Company, $1,500,000 of five-year 7 per cent convertible gold notes, at a price of 97 and interest to yield about 7.75 per cent. The notes are a direct obligation of the company and are further secured by collateral consisting of preferred stock of subsidiary companies and common stock of the Middle West Utilities Company in the proportion of $1,500,000 par value of stock to each $1,000 of notes. The notes are also convertible into the stock of the subsidiary companies and into the common stock of the Middle West Utilities Company in the same proportion.

Electric Trucks in Milk Delivery.—According to A. Jackson Marshall, secretary of the Electric Vehicle Section, National Electric Light Association, one of the electric commercial vehicle manufacturers has developed a very practical light-weight delivery wagon which is being extensively employed by retail milk dealers. This electric truck possesses the feature of external operation by means of a lever which permits the operator to move the "electric" forward and backward under its own power without climbing into the vehicle itself. Thus the electric vehicle competes successfully with the horse trained to move at the command of the driver. The vehicle is also cheaper to operate than a single-horse wagon, besides being much more dependable.

Detroit Strike Ended.—The electrical union, which called a strike May 1 at Detroit to insist on wages of $1 per hour with forty hours' work a week and double time for Saturday and all overtime, has failed to accomplish its purpose. Owing to the conditions in the reconstruction period the contractors thought it impossible to accede to the demands of the union and held out until a settlement was effected. Arbitration was at first refused by the union, but finally the matter was settled by giving the men $7.50 per day, with a week of forty-four hours, with time and a half for overtime, including Saturday afternoons, and double time for holidays. These are virtually the terms on which the contractors were willing to settle before the strike started. This agreement holds until Nov. 1.

Points to Danger of Petroleum Famine.—Congress will be asked to take steps to ward off an alarming shortage of petroleum and its products which seems likely in the near future, according to an emergency report of the Bureau of Mines recently transmitted to the House appropriations committee by Secretary of the Treasury Glass. Mr. Glass has asked that $50,000 be appropriated for an investigation looking to the conservation of petroleum and natural gas. The report discloses that underground reserves are 40 per cent exhausted and that we probably are near the peak of domestic production. The consumption of petroleum is increasing far more rapidly than domestic production. During 1918 there were imported from foreign countries 39,000,000 barrels of oil, while 27,000,000 barrels were withdrawn from stock.

Energy Waste in Living Cost.—Establishment of a nation-wide electric transmission system operated as a common carrier like the railroads is urged in a paper recently issued by the United States National Museum. Such a system is needed to conserve the country's energy resources, which at present are being wastefully utilized, it is declared. The paper attributes the present high cost of living to a great extent to waste of coal, oil and water power. There is too much duplication in the production of energy, in that coal is needlessly transported long distances to regions where water power exists in large quantities. This water power should be developed at once and the system of long-distance transmission installed. America, says the statement, has been able to maintain high wage scales only in so far as machines have replaced hand power and use has been made of natural resources.

Vail Urges Return of Telephones.—Disintegration of the country's telephone systems is threatened unless Congress at once returns them to private control, declared Theodore N. Vail, president of the Bell Telephone Company and President Robinson of the Independent Telephone Association in a joint statement issued at Boston. Expenses of the telephone systems have greatly increased during the past year, for wages alone at the rate of more than $20,000,000 per annum, says the satement. While this was inevitable by reason of larger proportional increases by the railroads and industries of the country, the revenues are inadequate to care for such increases and the deficit to the government to date on that account is large and steadily growing. The Postmaster-General ordered that steps be taken to secure adequate revenues, but contentions with the regulatory authorities of the states, not yet settled, have prevented the satisfactory adjustments. If such conditions continue, necessarily the credit of the companies will be impaired, proper expenses cannot be met, the best operating forces cannot be retained, needed extensions and satisfactory service cannot be provided. This condition will lead to a deterioration which in some localities may threaten a return to public ownership or operation in order to care, even inadequately, for public needs. Such a contingency can be prevented, says the statement, through prompt action by Congress. Just and speedy settlement should be made for all properties taken under existing law, that such balances now in the possession of the government may be restored to assist in the upbuilding and extension of the various systems for better public use. The conditions and regulation of operation should be defined so as to permit the companies to reëstablish and maintain a satisfactory service with reasonable rates without discrimination and to procure the benefits of legitimate competition.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Compensation for Use of Highways by Telephone Companies.—The Court of Appeals of Maryland has pointed out that the provision of the Civil Code giving telegraph and telephone companies the right to construct lines upon highways or across bridges of the state gives the company no right to such use without making compensation therefor (106 A. 260).

"Final Orders" of a Commission.—While in its strict sense a "final order" is the last or concluding order in a case, in the popular sense, and in the sense in which it is most used by the lawmakers, as well as by the legal profession, it is ordinarily considered to be such an order as is subject to review on appeal, writ of error or other appellate process, according to the Supreme Court of Appeals of West Virginia (99 S. E. 63).

Information Needed for Conviction in Meter Tampering.—In a prosecution for tampering with or changing electric meters before they could be tested by assistant state sealer of weights and measures, in violation of statute, evidence of the assistant sealer and superintendent of weights and measures that the meters had been tampered with or changed by defendant before they could be tested, where such facts were not of his own knowledge but merely from information, is insufficient to sustain conviction, according to the Supreme Court of Tennessee (210 S. W. 630).

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Charles H. Hubbell and **Douglas S. Meaden** have joined to form the firm of Hubbell & Meaden, Cleveland, Ohio, and devote attention to consultation on tax and accounting matters and to rate cases and other problems of utility companies.

John G. Learned, the new chairman of the Commercial Section of the National Electric Light Association, is assistant to vice-president in charge of the commercial, advertising and right-of-way departments of the Public Service Company of Northern Illinois. His association with the electrical industry began in 1898, when he was employed for two years in the service department of the Chicago Telephone Company. On leaving that concern he became a salesman for the Commonwealth Edison Company in its Northern division. During this period he completed the course at the Chicago Law School, and in 1902 he was admitted to the bar of Illinois. In 1905 he resigned from the Commonwealth Edison Company to become general contract agent for the North Shore Electric Company, with headquarters at Evanston, Ill., where he remained until 1911, when the North Shore Electric Company became a part of the Public Service Company of Northern Illinois. At that time Mr. Learned was made general contract agent for the Public Service Company's Northern and Western divisions. In August of the following year he was made assistant to the vice-president of the company. Since 1911 he has been particularly active in association work, holding the offices of secretary of the North Shore Electric Company Section in that year, chairman of the Public Service Company of Northern Illinois Section of the National Electric Light Association in 1913-14, and chairman of the committee on electric service in rural districts in 1911 and 1912. He was a member of the executive committee and chairman of the membership committee of the Commercial Section of the National Electric Light Association in 1912 and first chairman of the Lighting Sales Bureau in 1916. Mr. Learned is also a member of the educational committee of the Chicago Central Station Institute and has contributed a number of valuable papers and articles to the commercial literature of the electrical industry.

JOHN G. LEARNED

P. M. Parry, formerly manager of the Ogden division of the Utah Power & Light Company, has been made commercial manager of the company to fill the vacancy caused by the resignation of W. R. Putnam. Mr. Parry took up his new duties on June 1, when Mr. Putnam left to become vice-president and general manager of the Idaho Power Company.

Donald C. Barnes, Everett, Wash., heretofore manager of the traction and power properties of that city, has been appointed manager of the Seattle division of the Puget Sound Traction, Light & Power Company, to succeed A. L. Kempster. He will make his headquarters in the Electric Building at Seventh Avenue and Olive Street. Mr. Barnes is well known in utility circles. He has been associated with the management of Stone & Webster companies since 1905.

Major George F. Sever has been honorably discharged from the United States Army after a service of fifteen months and will establish consulting engineering offices in New York City. Major Sever during his service made extensive and detailed investigations of the electric power conditions in New England as well as on the Pacific Coast from Seattle to Los Angeles. His investigation covered careful analyses of the production of power by coal, oil and water and the comparisons of these different methods.

John A. Stevens, a prominent power-plant engineer, on May 17 was the guest of honor at a dinner given by associate engineers and assistants at the Hotel Thorndike in Boston to commemorate his ten years of engineering work. About forty members of the organization were present. Mr. Stevens was born in Galva, Ill., in 1868. Previous to entering the employ of the International Navigation Company in 1893, he served various apprenticeships in marine work. Later he served as an engineer for that company on different steamships and was promoted to first assistant engineer of the U. S. M. S. St. Paul. In 1896 he resigned to take the position of chief engineer with the Merrimack Manufacturing Company of Lowell, Mass., in which position he superintended the power work of the company's Southern mills and made all of the power-plant layouts and estimates. In 1909 Mr. Stevens resigned from the Merrimack Manufacturing Company and spent about three months in Europe collecting engineering information. He then returned to the United States and opened general consulting engineering offices, specializing in power-plant work.

I. E. Moultrop, who has been elected chairman of the Technical and Hydroelectric Section of the National Electric Light Association, is assistant superintendent of the construction bureau of the Edison Electric Illuminating Company of Boston. For a number of years he has been intimately connected with the work of the prime-movers committee of the N. E. L. A. and also with other committees of the A. S. M. E. and A. I. E. E. Mr. Moultrop was born in Marlboro, Mass., in 1865 and started his engineering career in 1882 with the Whittier Machinery Company of Roxbury, Mass. He left that company in 1892 to become engineer on mechanical construction work with the Boston Edison company and has since been connected with that company, advancing to his present position of assistant superintendent of the construction bureau, a department which handles all the construction done by the company. Mr. Moultrop has served on the N. E. L. A. prime-movers committee and the steam-turbine and gas-engineering committee, which preceded the former committee, about twelve years, having been chairman of the prime-movers committee for a considerable portion of that time. He has also served as manager of the American Society of Mechanical Engineers from 1908 to 1911 and as vice-president from 1912 to 1914. He is at present a member of the boiler code committee and power test code subcommittee on turbine testing of that body. He accomplished an important work for the A. S. M. E. in the capacity of chairman of the increase-of-member-

I. E. MOULTROP

ship committee for a number of years. When this work was started under his direction in 1912 the society had a membership of 4115, and in 1917 the membership was increased to 7704. He then resigned to fill the position of representative of the A. S. M. E. on the board of trustees of the United Engineering Societies, of which he is a member. He is also a member of the Engineering Council, representing the United Engineering Societies in that body. Mr. Moultrop has served as a member of a number of committees of the A. I. E. E. and at present is a member of the power-stations committee of that society. He was recently elected chairman of the Boston Section of the A. I. E. E. for the ensuing year. In Boston Mr. Moultrop has been a member of the board of governors of the Engineers' Club for the past six years and chairman of its membership committee. He is also a member of the board of governors of the Woodland Golf Club.

Dr. F. H. Newell, who has been elected president of the American Association of Engineers, with headquarters in Chicago, is head of the civil engineering department of the University of Illinois and is well known as an engineer. He has been called "father of the United States Reclamation Service," of which he was first chief engineer from 1902 to 1907 and director from 1907 to 1914. Dr. Newell has been active in all of the reform movements in the engineering profession in the last few years. He was one of the founders of the Washington Engineering Society and served as its president. He is a member of the American Society of Civil Engineers, American Society of Mechanical Engineers and Western Society of Engineers and was one of the original members of the Engineering Council.

R. W. Spofford has been made local general manager of the Manila Electric Railroad & Light Company, Manila, Philippine Islands, by the J. G. White Management Corporation, New York, N. Y., the operating manager of that company. Mr. Spofford was graduated from the United States Naval Academy at Annapolis and spent about five years in the navy. He was retired in 1911. Shortly thereafter he was engaged by the J. G. White Management Corporation and was assigned to the engineering staff of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga. He became general manager of that company in 1914. When the United States entered the world war Mr. Spofford, as a naval reserve officer, was called to the colors for service. With the signing of the armistice he was again placed on the retired list of the navy, with the grade of lieutenant-commander.

Leon C. Smith, Columbus, Ohio, has been provisionally appointed chief inspector by the Public Utilities Commission of Ohio to succeed James B. Dugan, who recently resigned to become superintendent of the Lima division of the Ohio Electric Railway. Mr. Smith has been assistant to Mr. Dugan.

T. C. Miller has been appointed chief engineer of the municipal light plant at Independence, Mo., to succeed A. L. Landsberg, who has resigned after being with the company for several months.

J. M. Walsh has resigned from the commercial department of the Scranton (Pa.) Electric Company to take up the duties of electrical engineer for the Gurney Electric Elevator Company at Honesdale, Pa. During the war Mr. Walsh was commissioned a lieutenant of coast artillery and served in France with a regiment of railway artillery.

R. W. Symes, the new chairman of the Accounting Section of the N. E. L. A., is general accountant of the Detroit Edison Company. He has been

R. W. SYMES

connected with that and subsidiary companies for the past fourteen years and has been an active worker on accounting committees of the N. E. L. A. for the past eight years. He has also been a member of the executive committee of the Accounting Section since that section was organized in 1915.

Prof. A. P. Little of Yale University has been appointed professor of electrical engineering in the Colorado School of Mines. Professor Little is a graduate of the University of Vermont, and for a short time after graduation he was associated with the New England Telephone & Telegraph Company in its electrical department. He left that position to become assistant professor of electrical engineering at the University of Syracuse, N. Y. Later he joined the teaching staff of the Oklahoma Agricultural and Mechanical College, where for five years he was head of the electrical department. From 1913 to 1917 Professor Little was connected with the public utility section of the Bureau of Standards at Washington. Here he was engaged chiefly in investigating standards for electric service, street-lighting service, and central-station heating service.

Obituary

Richard Stevens, son of the founder of the Stevens Institute of Technology, died May 18, at his home in Castle Point, Hoboken, N. J., at the age of fifty-one.

C. P. Larson, for ten years chief engineer of the Hughes Electric Company at Bismarck, N. D., died recently, following a year's illness. Mr. Larson was born in Denmark fifty-seven years ago, but came to this country at an early age.

William S. Liming, superintendent of the Scranton (Pa.) Electric Company, who died on April 19, had been in the employ of that company since May 3, 1902. He was formerly a member of the engineering staff of the Philadelphia Electric Company and had charge of underground construction in Philadelphia when the overhead lines were placed underground. Mr. Liming had been in poor health for the last three years.

Charles Whitman Wetmore, formerly for many years president of the North American Company, New York, N. Y., which controls the Milwaukee (Wis.) Electric Railway & Light Company and the Union Electric Light & Power Company, of St. Louis, Mo., died on June 2 at his summer home. Mr. Wetmore was born in Michigan sixty-five years ago. He was educated there and at Harvard, and was graduated from the law school in 1877. After graduation Mr. Wetmore went to New York and began the practice of law with the firm of Barlow & Olney, which afterward became Barlow & Wetmore. In addition to his connection with the North American Company Mr. Wetmore was one of the organizers of the Montana Power Company and a director of several other public utility companies. About five years ago he retired from active business and lived in Surrey, England, until the war broke out, when he returned to the United States.

Dr. Henry Wilde of Ardsley Edge, Cheshire, England, who recently died at the age of eighty-six, was one of the early investigators in electrical work. He is credited with having discovered in 1868 the synchronizing property of alternating currents to control the rotation of dynamos in generating stations, and he invented a dynamo-electric machine in 1864 for the production of electric light. He applied the dynamo with other inventions to the production of the searchlight for the Royal Navy and to the electrodeposition of metals from their solutions, from 1868 to 1880. He was a frequent contributor of original papers to the *Philosophical Transactions* and *Proceedings* of the Royal Society, the *Philosophical Magazine*, the memoirs of the Manchester Literary and Philosophical Society and the *Comptes Rendus* of the French Academy of Science. Besides devoting his life to science, Dr. Wilde gave substantial aid to English institutions for the promotion of these objects.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

HIGH-TENSION INSULATOR SALES ARE NOT LARGE

Judging from Inquiries and the Amount of Work Projected, the Prospects for the Future Are Brighter than They Were

While there are a number of inquiries out for high-tension insulators, actual sales, manufacturers report, are below those of last year and not very good. Generally speaking, sales are for small quantities. This is to be expected as new long lines have been very scarce. Considerable work is projected, and some new work is under way.

Insulator sales consequently are increasing and, judging from the amount of projected work, the prospects for future business are bright. Many inquiries are coming from without the United States.

One manufacturer not long ago advanced prices on small lots and feels that there is a possibility that prices on carload lots and upward may be advanced.

TRANSFORMER PRICES NOT EXPECTED TO GO LOWER

Owing to Small Increases During War Period Drops in Raw Materials Should Not Necessarily Be Reflected in Finished-Product Prices

Toward the end of March a price reduction of about 11 per cent was established for distribution transformers. In the opinion of those in close touch with the manufacturing of transformers, the bottom has been reached in prices of such equipment. It is pointed out that labor costs show no tendency whatever to decrease. Some material costs are running lower than during the height of the war.

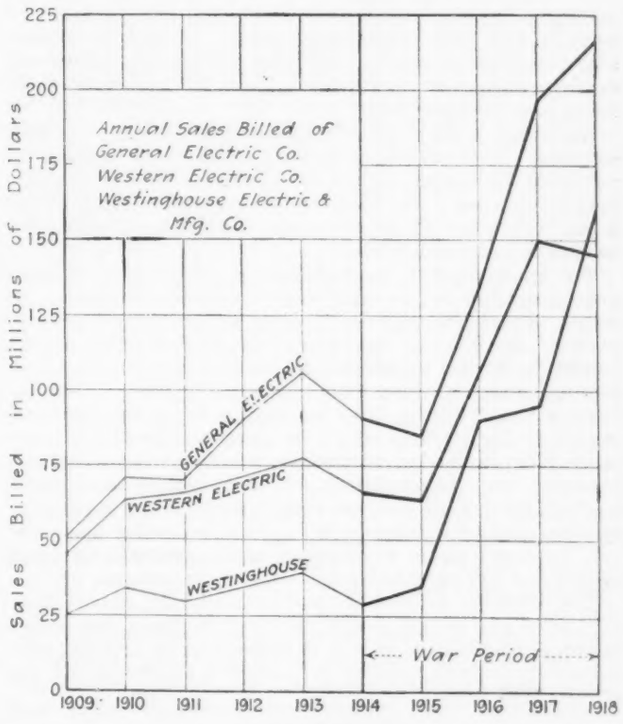
Thus magnetic steel is now costing the transformer manufacturer about 9 cents per pound, compared with 14 cents in the period of maximum demand and allowing for wastage in the fabrication of lamination sheets of the proper shape. The maximum cost of this steel was practically equivalent to the price of copper the year before the war. Considerable stocks of copper and steel which were purchased at prices in excess of ruling quotations are yet to be worked up at the factories. The overhead cost in transformer manufacture and the labor cost are to-day probably not far apart. Insulating materials are a little easier in price than last year, but with present high labor and overhead charges, with existing high costs of maintaining sales work in the field and with outputs far below the capacity of the factories, it is held that no reasonable basis for price reduction exists, bearing in mind always that the price advances of transformer equipment during the war did not exceed about 60 per cent compared with from two to five times that advance in many other manufactured commodities. There is no certainty that the prices of steel and copper will not advance materially during the present year, and neither is it positive that no further increases in the cost of labor will be registered.

Little is being heard of guarantees covering price reductions this year in the transformer quotations now being offered. Since the prices of such equipment did not follow the advances in material cost during the war, it results that very substantial drops can take place in raw-material costs before any sympathetic fall in product prices may be expected. Possibly in the future mass production on the basis of greatly increased labor efficiency may allow a moderate recession to be established, but the prospects are that prices now current will form the basis of quotations for a long time hence.

SALES OF THREE LARGEST ELECTRICAL DISTRIBUTERS

Last Year Brings Total of $522,421,000, While Unfilled Orders Amount to the Sum of $172,513,000

Figures just made available show the business done last year by the three largest distributers of electrical goods—the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Western Electric Company. Both the General Electric and Western Electric



SALES BILLED FOR PAST TEN YEARS OF THREE LARGEST DISTRIBUTERS OF ELECTRICAL GOODS

figures are for the calendar year 1918, while the Westinghouse figures are for the fiscal year ended March 31.

Sales billed last year as shown in the diagram were: General Electric, $216,815,000; Western Electric, $145,226,000, and Westinghouse, $160,380,000, a total of $522,421,000. Both General Electric and Westinghouse showed a gain over the previous year, the former $20,000,000 and the latter $65,000,000. Western Electric sales dropped behind those for 1917 by $5,000,000.

Unfilled orders were as follows: General Electric, Jan. 1, $80,000,0000; Western Electric, Jan. 1, $26,265,000; Westinghouse, April 1, $76,248,000, a total of $172,513,000. This total is less than that unfilled a year previous by about

$84,000,000. On April 1, 1918, however, Westinghouse unfilled orders totaled $147,858,000.

The above figures, it is well to remember, do not represent altogether the regular products of the three companies. Considerable war work was done which changed the relative importance in the sales ladder of many of the companies' normal products. Moreover, there are included certain munition sales and electrical articles of a war nature never before manufactured.

Furthermore, when making comparisons with previous years care must be taken not to confuse values with volumes. It has been estimated that electrical goods, generally speaking, were about 65 per cent higher in 1918 than before the war. If a comparison of volumes is desired, the figure will be found useful. On this basis the volume of goods billed last year was around 50 per cent more than the volume billed in the record pre-war year of 1913.

BRITISH RESTRICTIONS ON ELECTRICAL IMPORTS

Efforts Being Made to Hold Down Imports Where They Will Compete Too Severely with Domestic Manufacturers

Announcement is made by the War Trade Board of a number of changes in the import restrictions of Great Britain relative to electrical apparatus and equipment. It is well known that British electrical manufacturers are making every effort to keep down the imports of lines that compete with domestic manufacturers. In fact, it is probably true that a committee of electrical manufacturers will determine when licenses will be issued for imports of those items that require them.

Restrictions have been removed from electric vacuum cleaners, small motors up to ¼ hp., rolling-mill motors for auxiliary driving up to 250 hp. and single-phase repulsion induction motors, electrical measuring instruments of all kinds with 4-in. dials and under, and flexible wires for telephone and house wiring.

The importation of the following articles will be licensed only exceptionally, as and when required: Incandescent lamps, meaning complete lamp bulbs with filaments and filament supports, contacts and tubes; electric house-service meters; electrical measuring instruments of all kinds, excepting those with 4-in. dials and under; electrical cooking, heating and domestic laundry appliances, except washing machines and vacuum cleaners; electric cables and wires other than flexible wires for telephone and house wiring; batteries for pocket lamps; electric motors and parts thereof, other than for renewals (except small motors up to ¼-hp., rolling-mill motors for auxiliary driving up to 250 hp., and single-phase repulsion induction motors); electrical accessories and parts thereof, including fan motors.

The following articles are to be rationed for importation: Dry cells and primary batteries, except those for pocket lamps, to be admitted at rate of 20 per cent of 1916 imports; bulbs for electric lamps to be admitted at rate of 50 per cent of 1913 imports.

REGULATIONS AFFECTING ELECTRIC FAN EXCISE TAX

Electrical Goods Primarily Automobile Accessories Subject to Tax Irrespective of Their Ultimate Use

A number of bills have been placed before Congress for the purpose of removing the shackles on business by rescinding excise and luxury taxes. This movement is of particular interest to the electrical trade, owing to the inclusion of electric fans and electrical automobile accessories in the former and portable lamps in the latter.

These excise taxes are on goods sold after Feb. 25, 1919, even though the order was placed prior to that date. Thus, according to the law, fans of last year's model held in manufacturers' stock and sold subsequent to Feb. 25 are subject to the tax of 5 per cent. This, however, does not apply to second-hand fans.

According to a ruling just received by the ELECTRICAL WORLD from Deputy Commissioner John E. Walker, the ordinary portable electric fan, and also fans of a similar type screwed to a wall bracket or other support but capable of being easily moved, are taxable. Ceiling fans, exhaust fans and blowers, permanently attached and requiring separate walls and fixtures, and which necessitate workmen to remove them, are not portable fans within the meaning of the act.

The tax is on the sale price and not the list price of the article. A cash discount or other discount made subsequent to the sale is not deductible in computing the price for the purpose of the tax. Where, however, fans are sold over a period of time under an agreement for a quantity rebate, the tax, considered on the gross price, may be adjusted in the terms for the month in which the price is finally determined. No deductions are allowed for commissions to agents and other expense of the sale.

The tax may be included in the selling price and need not be specifically mentioned to the customer at the time of sale. If the price of the article is increased to cover the tax, the tax is upon such increased price. If the dealer enters on his invoice as a separate item the exact amount of the tax, stated to be the tax, such amount may be excluded in determining the price at which the article is sold.

In respect to electrical articles used as automobile accessories but also having other uses, the commissioner stated that if primarily for use in connection with an automobile they are subject to the tax, no matter what the ultimate use. The commissioner stated that if any doubt, reasonable and bona fide, exists as to the special adaptability of an article, the fact that it is sold by a manufacturer to be used with an automobile or to an automobile accessories dealer will determine its taxability.

The Internal Revenue Commission has just published "Regulations No. 47—Relating to Excise Taxes on Sales by the Manufacturer," in which a large number of technical questions that have arisen since the tax went into effect are answered.

STORAGE-BATTERY MAKERS STILL ON BACK ORDERS

Although Current Sales Are Far Below Production Capacity, It Will Be Early Fall Before Large Stocks Can Be Accumulated

Returning conditions of peace find manufacturers of storage batteries trying to catch up on their back orders. In the case of many manufacturers government requirements for special types of storage batteries kept them behind on both government and commercial orders. The end of the war found some of them, even with enlarged manufacturing space, so far from conditions of immediate delivery that in some cases it has been figured it will be fall before any stocks can be accumulated.

In 1913 and 1914 the market for storage batteries was far below that of to-day, and most manufacturers were on their upward curve of production. One manufacturer's production to date this year is double that of the same period last year, while current production is about ten times as great as in 1913 and 1914.

So far the present demand is below the increased capacities inaugurated during the war, but back orders are keeping the factories going to capacity. One manufacturer figures this present demand as 40 per cent of his capacity.

Sales of batteries for car lighting are practically nil. The industrial and commercial truck and the passenger vehicle battery markets are reported as not up to snuff. On the other hand, the automobile requirements are increasing at a great rate, while unfilled orders of war times are well under way to completion. Another line of increasing activity is the farm-lighting business.

There have been price changes since 1913 all along the line. One manufacturer has increased about 20 per cent

since 1913, while another has increased prices about 100 per cent since 1915. Others have reported increases but withheld amounts. Since 1913 the relation of labor cost to total cost has been found up 5 per cent and manufacturing and sales cost ratios have also gone up 5 per cent. On the other hand, charge for material is 10 per cent less, a factor in the total cost of manufacturing. This may not be general, but is an instance. Battery costs have been found steady since the first of the present year.

Most manufacturers have sufficient stock of raw materials on hand to continue for several months, the general term being six months. This means considerable material on hand compared to previous years, considering capacity increases since 1913 of from three and one-half to ten times. Stocks of finished batteries could with difficulty be maintained, but manufacturers hope to be able to arrive at the point where by fall they may have started stocks of semi-finished batteries. These must be held till ordered so as correctly to group, arrange and test them. One manufacturer expects to be able to stock 10 per cent of his battery capacity in this way.

In general export sales have been found rather light, although in one instance they are about 25 per cent of domestic sales.

In the commercial type of battery there have been few developments of late. A manufacturer states that slight changes have been made in methods of manufacture and in certain parts. Another reports that on account of a slight change in shape of one part he is able to guarantee 25 per cent more life to his battery.

METAL MARKET SITUATION

Price of Copper Advances 1¼ Cents, and a Fair Amount of Buying Is Reported

Copper is up again. Since the last report electrolytic has advanced from 16.37½ cents a pound to 17.62½ cents for spot, June and July shipments, while August shipment is held at ½ cent higher. Wire base is following right along at 19½ to 20 cents a pound at the mill. The scrap copper and wire market is right in step with another ¼-cent advance.

The copper buying movement is keeping up, although sales at the end of last week fell off somewhat. The market for exports to England, France and Italy is not very strong at present, but considering the way those countries are absorbing their stocks, it cannot be long before their imports will again be in evidence. Their import needs seem to be principally for wire bar.

Spelter continues with an easy upward movement and the market is rather strong. The War Trade Board announced that on June 1 there remained undistributed 1615 tons of allocated tin. This means a reduction in stock of about 50 per cent since May.

NEW YORK METAL MARKET PRICES

	June 3	June 12
Copper:	£ s d	£ s d
London, standard spot	79 5 0	79 10 0
	Cents per Pound	Cents per Pound
Prime Lake	16.75	17.75
Electrolytic	16.37½	17.62½
Casting	16.00	17.25
Wire base	18.00 to 18.50	19.50 to 20.00
Lead, trust price	5.25	5.40
Antimony	8.37½	8.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.50	6.97½
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	32.00 to 33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	14.50 to 14.75	14.50 to 15.00
Brass, heavy	8.00 to 8.50	8.00 to 8.75
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	4.50 to 4.60	4.60 to 4.65
Zinc, old scrap	4.50 to 4.75	4.50 to 4.75

THE WEEK
IN TRADE

FAN season has opened up. The hot weather of last week moved large quantities of fans and in instances cleaned out jobbers' stocks. Other socket devices continue to sell in large quantities.

Wire is slightly higher, but otherwise prices are steady. An upward movement, however, would not be surprising within the next few weeks.

Construction, especially of dwelling houses, is going ahead rapidly and affording a growing market for electrical equipment.

Collections are in good shape and credits show no change.

NEW YORK

June is opening up better than May, according to jobbers' reports. There is nothing startling in the market, however. The fan business, of course, adds considerable activity to the trade.

As to building, there has been reported a general branching out among the silk manufacturers. Additions are being made in the rubber industry, with its resulting demand for larger-size motors.

The assistance of large insurance companies is being sought in the financing of pending building operations. Their heavy participation in Liberty loans may not permit them to place so much money on real estate mortgages as might be expected.

FANS.—The hot spell of last week gave electric fans a push that cleaned some dealers and jobbers out of stocks. One jobber disposed of practically his entire stock of fans, and rather than purchase fans of another make he is waiting for factory deliveries. The same factory has had hurry orders to fill all over the country. Other jobbers have reported sufficient stocks to weather the heat waves that will undoubtedly come. They have ordered reasonable stocks and these are being replenished periodically. In some cases, however, manufacturers figure that only 50 per cent of jobbers' orders have been placed. Deliveries for certain factories have slowed down somewhat.

SCHEDULE MATERIAL.—Jobbers report a slight improvement in the demand for wiring material, with sufficient stocks to handle expected business.

FLEXIBLE ARMORED CONDUCTOR.—No apparent relief in manufacturers' deliveries has been found, and many jobbers report empty stocks. Demand is still heavy.

MOTORS.—Fractional sizes are still finding almost unprecedented demand, and inability to deliver is holding up some motor-driven appliances. Small sizes for industrial use have a fair demand, but not so great as to prevent the gradual building up of stocks. Large-motor business is reported on the increase.

APPLIANCES.—Motor-driven appliances are in exceptionally good demand. One make of vacuum cleaner is reported a month behind on deliveries. Washing machines have an extremely good call, and new companies appear in the field very frequently. Ironing machines for the household are increasing in popularity. Recently inquiries have been received for motor-driven ice-cream freezers.

RIGID CONDUIT.—The market is light. Prices are still on card 41, but when commercial and apartment building sets in in full force it is expected that prices will advance.

LIGHTING EQUIPMENT.—Portables have only a light demand at this time. Illumination for show windows is under way in good shape. Residence lighting is going stronger than a short time ago. Considerable activity is still noticed in commercial lighting for offices on account of the changes in methods of illumination and changes in

office location. Glassware factories are reported running to capacity. Deliveries are around three to four weeks.

WIRE.—Bare copper wire bases have been reported at 19½ and 20 cents. Weatherproof is found at 20 to 22 cents, annunciator around 27 cents and lamp cord 20-cent and 21-cent base. Two rubber-covered lines advanced slightly this week.

TABLE HEATING APPLIANCES.—Some dealers and dry-goods stores have noticed a slight increase in sales of toasters, percolaters, etc., in the latter part of May and in June, in connection with June weddings. Jobbers are hardly affected at this time.

CHICAGO

The revival of industry is well under way in the Middle West and is most marked in those industries which bore the brunt of war-time privation. Such industries include automobiles, jewelry and some branches of the electrical industry. Industrial expansion, especially in the smaller towns, is being curtailed by the lack of proper housing facilities. Manufacturers are therefore finding it necessary to build homes for their employees.

In the city of Chicago five new apartment houses were projected last week, involving an expenditure of some $3,000,000, besides which a one-and-a-half-million-dollar hotel is announced for the south side. Actual building permits are only averaging about 150 a week for the city of Chicago, or about one-third of the requirements under normal conditions. A firm of engineering contractors in the city has announced that it will proceed to build five grain elevators of 25,000 bushels each and one of 30,000 bushels capacity in the states of Idaho, Kansas and Iowa, in addition to an elevator of 200,000 bushels capacity in Atlanta, Ga. St. Louis appears to be on the threshold of an extensive industrial boom. The Scullin Steel Company is making plans for a two-million-dollar addition to its plant and will probably require some 8000 hp. in 25-cycle motors in addition to transformers and other electrical equipment.

COPPER WIRE.—There is a strong demand for wire, and it is expected that the present base of 21 cents for weatherproof and rubber-covered and 19 cents for bare wire will be increased shortly. The demand is practically all for house wiring, and comparatively little wire above No. 6 is being sold.

SCHEDULE MATERIALS.—Business has been sub-normal, and a price reduction of 10 per cent has been made by some jobbers to stimulate business.

TRANSFORMERS.—Distributing transformers up to 200 kva. are not in great demand. Price reductions have not materially affected business, owing to the lack of building.

WIRING PORCELAIN.—Knobs, tubes and similar material are down about 20 per cent. This drop, it is reported, was made for the sole purpose of stimulating business, and it has generally succeeded. One manufacturer is now sixty days behind as a result of the rush of business which ensued.

MOTORS.—In motors of 1 hp. and above the principal demand is in sizes up to 25 hp. for both direct current and alternating current. These motors are going to many industrial plants which were unable to get motors during the war and are now bringing their maintenance work up to date. The railroads are also buying motors within the limits given. Candy manufacturers are expanding as they expect to increase their business under prohibition. Manufacturers making motors up to 200 hp. are in most instances better able to supply the large motors especially up to 100 hp. and 150 hp. than they are the smaller sizes.

VACUUM CLEANERS.—Some of the manufacturers are behind in their deliveries about sixty days.

FARM-LIGHTING OUTFITS.—One manufacturer reports that he is behind more than sixty days on deliveries, the reason being the combination of large demand and difficulty in obtaining labor.

IRONS.—One maker has reduced his price 50 cents.

BOSTON

An excellent volume of business continues from week to week. Deliveries are so good in most lines that no serious difficulties are experienced in maintaining stocks, though here and there manufacturing facilities appear unequal to the demand. Prices rule firm, with stiffening tendencies on copper wire. Domestic appliances are enjoying a wonderful sale. Labor conditions are unsettled, and strikes are threatened in telegraph and telephone circles. It is also rumored that electric wiremen are getting uneasy. Contractors are not able to pick up building work on a statewide scale as yet, but many small jobs are under construction. The extreme heat of last week boomed fan sales finely. Personal visits to jobbing stock rooms reveal a large amount of diversified material on hand, and little chance of shortages seems likely this season outside a few chronically depleted lines. Collections appear to be running along evenly, with fairly satisfactory underlying conditions.

WIRE.—Weatherproof was quoted at 22 cents base, bare at 19 cents, and rubber-covered at 23 cents. Insulated wire shows a decided advance over last week, and local agencies are enjoying a somewhat increased demand.

FANS.—Record-breaking high temperatures for early June gave a tremendous spurt to the fan market last week. One large jobber is reported to have sold 3000 fans in the first six days of June. Most jobbers did not run out of fans, however. Larger sizes were in heavy demand, and a good grade was handled in smaller outfits. Retail stocks were shot to pieces after the mercury hit 98 deg.

WASHING MACHINES.—The demand increases, and deliveries are still well maintained. A representative retailer sold 200 washers in two recent weeks. At this rate trainload shipments will be wanted before long.

VACUUM CLEANERS.—A heavy trade is being cared for. Manufacturing facilities are hard-pressed to meet the demand, and some shortages are encountered now and then. On the whole, deliveries are not so well maintained as on washers at this time.

LAMPS.—Factory stocks are being rapidly built up to meet the fall demand. All lines are now reported to be in ample supply.

ELECTRIC SIGNS.—A slow revival of sign business is in progress. Materials are so plentiful now that little obstacle can be seen to expansion along broad lines. Keener competition in the retail trade will shortly develop a technique of electric sign practice that will be felt in fields now lying dormant.

MOTORS.—A dull market continues, with fairly good sales in smaller sizes, but sub-normal demand for new installation equipments. Prices show little or no movement.

FIRE-ALARM SIGNAL EQUIPMENT.—Business is quiet, municipal improvements centering on street construction to employ labor more widely. Considerable activity is noted in the sale of police signal apparatus, owing to crime waves. Industrial fire-alarm demand is dull.

METERS.—Trade is improving somewhat, with a decidedly good demand from Connecticut. Building operations in that state are quite active.

ELECTRIC TABLEWARE.—A good retail trade is being looked after, and no difficulty is reported as to supply. Retailers are featuring this apparatus to advantage.

SCHEDULE MATERIAL.—A moderate business is being handled, but stocks will stand a much heavier drain than this without running short.

INDUSTRIAL ELECTRIC TRUCKS.—Business is picking up somewhat, and inquiries are in good volume. A little government buying is to be seen. Bids are reflecting close competition.

ELECTRIC WATER HEATERS.—Great interest has been aroused in water heating for "all electric" kitchen service. An Augusta (Me.) group meeting of central-station men last week brought out much practical information as to requirements and achievements, and an early and rapid development of equipment for the local market would not be surprising.

ATLANTA

Business in almost all lines continues active and a free movement of material is evident. The first day of the telephone operators' strike at Atlanta created some confusion, but since then all channels of communication have been open with some small delays. The telegraphers' strike in sympathy is being little felt so far. The "Morris plan of banking," which has been established in the East for some time, has been extended to the Southeast, and it is expected that appliance sales will be further stimulated as a result, permitting dealers to discount the paper of customers. The volume of appliance sales is steadily increasing as all interests are widening their scope of activity.

FANS.—Continual rains with an attending coolness considerably below normal has slowed up the movement of fans compared with the flurry of two weeks ago, when seasonal temperatures were expected. Stocks are in good shape, with a possible shortage in the 32-volt product.

WASHING MACHINES.—One manufacturer is falling behind in deliveries, which is being reflected in this section. The jobbers find it a difficult matter to keep the demand supplied. A few jobbers, anticipating the present demand, ordered well in advance and their stocks are in fairly good condition. Prices are steady.

WIRE.—The call for all wires is excellent. Weatherproof base advanced this week from 21 to 22 cents. Requirements for rubber-covered appear to be increasing, but prices are somewhat unsettled, ranging on No. 14 anywhere from 20 to 22 cents.

RANGES.—A slight revival is noted and activity has been stimulated through efforts of specialists and service stations of the large appliance companies. Local stocks are large and factory shipments are good. Prices remain unchanged.

MOTORS.—A quicker movement is observed in fractional-horsepower and capacities up to 25 hp. This is explained by the fact that a number of small manufacturing plants are being started. Then, too, last week's price adjustment may have affected the market to some extent. Shipments are nearing normal.

SCHEDULE MATERIAL.—Prices are firm. The demand has stiffened this week in response to contractor requirements for residence and apartment construction. Local stocks are being well maintained by incoming shipments.

INCUBATORS.—This item is receiving more attention and sales are becoming more active.

SAFETY SWITCHES.—There is big business being transacted, and present indications point to a larger volume of sales. The "safety first" movement, combined with city ordinances and the efforts of city electricians, has tended to extend the demand for apartment and industrial cutins. A 30-amp. size has been put on the market that compares favorably in price with the open-knife type. Factory deliveries are normal.

STORAGE BATTERIES.—Dealers state that factory facilities have improved to such a point that shipments are arriving rapidly and the shortage of a few weeks back is no more in evidence. The demand is steadily increasing, but stocks are ample.

INSULATORS.—The movement on glass has slackened, while shipments are good and prices remain steady. Deliveries on porcelain have reached normal. The call is spotty, and on the whole transactions are at a low level.

POLES.—Independent telephone buying and small municipal plant extensions and maintenance have propped up this item. Florida and South Georgia are leaning toward cypress. The demand for chestnut predominates, but Western cedar is making substantial inroads, even though chestnut poles are being offered at a much lower price. Deliveries from all points are reported as being excellent.

HARDWARE.—Although prices have remained fairly steady of late, the general market is in an expectant attitude and large transactions are scarce. Buying in small lots is frequent, however, and the volume of business at this time is all that can be expected. Stocks are good.

SEATTLE—PORTLAND

The impression prevails that better business is just around the corner and that before midsummer the industrial life of the Northwest will have been resumed on a scale approximating war-time conditions. Jobbers in Seattle during the past week reported sales light, which is true of every large city in the Puget Sound district. Projected industrial enterprises, calling for large electrical installations, are still on paper. The Western Rolling Mills, Hoquiam, Wash., are in the market for a number of large motors.

Dealers, on the other hand, report a comparatively active week. Sales of house-wiring devices, domestic appliances and electric tableware especially show a noticeable increase. Prices, with the exception of certain sizes of copper wire which moved up last week, stand firm. Collections are in excellent shape. No new requests for extension of credit are reported, and no new credits of any consequence have been placed for several weeks.

The volume of building in Seattle in May was more than three times what it was in January of this year and exceeds the volume of May of last year by $500,000.

It is reported that one of the largest wireless stations in the world is to be erected in Seattle by the War Department. The station will connect with another to be installed at Fairbanks, Alaska.

ELECTRIC TABLEWARE.—The two largest dealers in Seattle report increasing sales of percolators, toasters and chafing dishes. Percolators especially are showing increased movement, closely followed by toasters.

FANS.—Seattle and the Puget Sound district have had no weather which could be characterized strictly as fan weather. The actual summer season is short and exceedingly mild, and extremely hot days are the exception. Dealers with but few exceptions carry little if any stocks, while jobbers' stocks are just sufficient to tide over a few days.

SAN FRANCISCO

Orders continue to arrive, and their total is of surprising volume. Credits and collections are in healthy shape. Trade acceptances of ninety-day duration are almost universally used to cover device sales and big jobs. The natural products of California, upon which the state's prosperity chiefly depends, are of encouraging volume. Eastern shipments are a little slower, now running over a month for less than carload lots and about three weeks' time for carload shipments. The only discouraging feature is the inability of many factories to make prompt shipments.

VACUUM CLEANERS.—A few Eastern shipments have been received, but, generally speaking, there has been a temporary stagnation due to poor deliveries. Those who placed advance orders with several factories are receiving small monthly quotas.

IRONING MACHINES.—A more determined effort has been made to impress the public with the idea that ironing machines should accompany the majority of washing-machine sales, but in spite of floods of inquiries sales have been of disappointing volume because of the lack of stock.

WASHING MACHINES.—The market is very brisk, and it is reported that several additional outlets will shortly be obtained for sales efforts, such as a certain large and conservative department store, besides many firms which have recently deserted contracting for device sales.

SMALL MOTORS.—Small-motor applications, such as sewing-machine motors, drink mixers and the like, have been considerablly hurt by a strike in a large factory. Prices remain steady, and there are an increasing number of quantity sales.

FIXTURES.—The local fixture game has greatly changed during the past few years, because of the element of the owners' personality in the choice and the elimination of many of the smaller cumbersome metal fixtures for glassware. Designing and drafting departments are more busy than the sales departments. Good stocks are accumulating.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00
Coil to 1000 ft	82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

BATTERIES, DRY
NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	40	40— 41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued
CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00	$20.75	$21.50
½-in.—	30.00	21.50	20.50

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
⅜-in.—	$33.00	$17.50	$16.25
½-in.—	36.00	19.00	17.25

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	⅛ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅛ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 6.1%	+1% to 8.1%
2500 to 5000 lb.	2% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

FLATIRONS
NEW YORK

List price	$6.50 to $7.50
Discount	25%

CHICAGO

List price	$6.35 to $7.50
Discount	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

	List
Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

	List
Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.01–$35.18
Coil to 1000 ft	25.94– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00
Coil to 1000 ft	21.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–40%	10%–32%
$10.00 to $50.00 list	30%–50%	20%–43%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $22.40
1/5 to std. pkg	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-qmp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 30%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.41
No. 18, full spools	.35– .39

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.46
No. 18, full spools	.41

WIRE, RUBBER-COVERED, N. C

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	18.54	18.54	13.90
10	24.96	24.96	16.64
8	34.02	28.35	22.68
6	53.94	44.95	35.96

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$17.50–$18.50	$10.00	$9.25–$10.00
12	22.05	22.05	18.90
10	29.68	29.08	25.44
8	40.79	34.62	24.62
6	63.84	54.72	54.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$26.00–$29.25
25 to 50 lb	26.00– 25.25
50 to 100 lb	25.00– 23.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$25.25 to $25.75
25 to 50 lb	25.25 to 25.75
50 to 100 lb	25.25 to 25.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Portable Color-Matching Unit for Counter Use

Four portable "Trutint" units for producing an accurate color-matching light with clear gas-filled lamps have

HARMONIZES WITH APPOINTMENTS OF HIGH-CLASS STORES

been standardized by the Nela Specialties Division, National Lamp Works of the General Electric Company, Cleveland, Ohio, and are now being manufactured for use on dry-goods counters or tables. They are more elaborate fixtures than the previous units in the line and are intended to harmonize with the appointments of high-class shops.

Safety-Fused Oil Starters for A. C. Motors

For controlling alternating-current induction motors and not only affording protection against overloads, short circuits and single-phase running, but also preventing the abuse of fuses, "Type I" safety-fused oil-motor starters have been brought out by the Condit Elec-

PROTECT AGAINST OVERLOADS, SHORT CIRCUITS AND SINGLE-PHASE RUNNING

trical Manufacturing Company of South Boston, Mass.

These starters are supplied in two, three and four poles for 250-volt and 600-volt service and are arranged with fuse clips to accommodate NEC inclosed fuses. Undervoltage or shunt-trip attachment can be obtained. They conform with the safety code of various states, may be locked in an open position, and are arranged with knock-out holes to take either conduit or open wiring. In their safety, maintenance and installation features these starters resemble the "Type N-1" oil starters with overload coils made by this company and described in the ELECTRICAL WORLD for April 5, 1919.

Soldering Iron for Incandescent Lamp Terminals

For soldering the terminals of incandescent lamps a specially designed electric soldiering iron is being made by the William H. Dalton Company, 4 Charlotte Street, Salem, Mass. The iron contains a copper rod which is capable

SOLDERING ROD IS EASILY RENEWABLE

of being readjusted and pushed downward as it is used. To do the work required this rod must be small in diameter—$\frac{3}{16}$ in. (4.77 mm.)—and must be cleaned frequently. Necessarily the length of the rod is gradually decreased. However, it is possible to renew the rod very conveniently, the maker states. A stand for fastening the soldering iron to bench or work table is supplied, as well as a length of cord and a plug for lamp-socket connection.

Three-Heat Electric Iron

By means of a heat-regulating plug three different heats may be obtained in the "Everhot" electric iron, which the Redtop Electric Company, 8 West Nineteenth Street, New York City, has brought out for domestic and factory use.

The iron is so constructed that when the plug is adjusted for the first or low heat an energy consumption of 125 watts is obtained. The second or medium heat uses 275 watts, while in obtaining the third or high heat 550 watts is used.

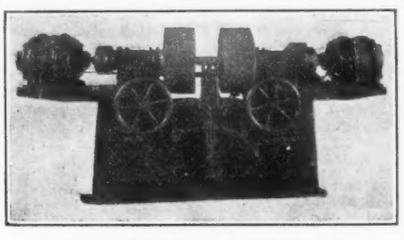
THREE HEATS OBTAINED BY CHANGING POSITION OF PLUG ON TERMINALS

The heating area covers the entire bottom of the iron, which weighs 6½ lb. (3 kg.) and is supplied with a heel stand, 6 ft. (1.8 m.) of cord, and a plug for lamp-socket attachment as well as the heat-regulating plug.

There are three connector terminals on the iron which are connected to the resistor so that changing position of plugs gives the different heats.

Electrically Driven End-Surface Grinding Machine

To finish the end surfaces of various parts an electrically operated grinder has been developed by C. L. Hawes, 12 Adams Street, Ashtabula, Ohio, for use in machine shops and factories. It carries two cup-type emery wheels with 6-in. (15-cm.) faces, diameters of 18 in. (45 cm.) and 3-in. (7.6-cm.) faces on the cap side. Each wheel is directly connected to a 5-hp., 1200-r.p.m., 60-cycle, alternating-current motor. The end surface of the parts can be ground



FOOT PEDAL CONTROLS MACHINE

to any desired length from 3 in. to 12 in. (7.6 cm. to 30 cm.), since adjustable stops are provided.

By pressing down a foot pedal the operator spreads the wheels apart so that the work can be placed in a jig to be ground. When the operator releases the pedal the wheels close automatical-

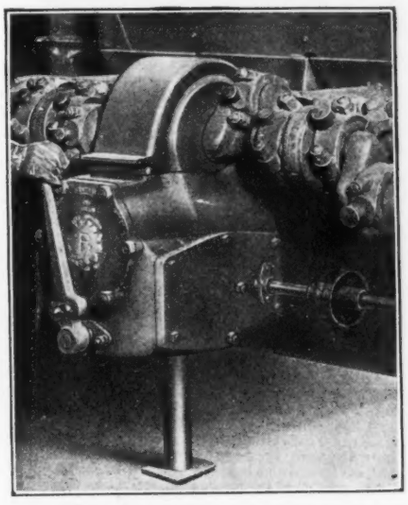
ly, the jig in the center being moved mechanically across the face of the wheels so that they will wear true and the ends of the work will be ground square. Either wheel can be adjusted independently of the other to any distance from the center, this being done by handwheels at the front of the machine.

The grinding machine is equipped with roller bearings. High-speed flexible-type couplings are used to connect the grinding spindles to the motors.

Two-Speed Gear Box for Stokers

The two-speed gear box recently placed on the market by the Sanford Riley Stoker Company of Worcester, Mass., differs from customary stoker gear boxes since it contains, in addition to the worm gearing, a double set of spur gears. These gears are so arranged that by shifting a lever on the box from high-speed to low-speed position or vice versa the coal feed may be retarded or accelerated. On large units the fire can therefore be leveled, thinned or thickened, as required.

When a number of stokers or gear boxes are driven by a single prime mover, any stoker can be operated almost independently of all other stokers or gear boxes through the use of this box. With the stokers driven by an ordinary engine or motor double the usual range of speed is obtained. This is an advantage at high ratings (300 to 350 per cent). The stoker countershaft at these loads usually has a speed of from 400 to 450 r.p.m., and if an engine were used it would be required to operate at from 100 to 150 r.p.m. Such low



SHIFTING THE LEVER ACCELERATES OR RETARDS COAL FEED

speeds are liable to stall the engine and are wasteful of steam; but by shifting the two-speed gear-box lever from high to low speed the engine can operate from 200 to 300 r.p.m., an efficient speed for economical operation.

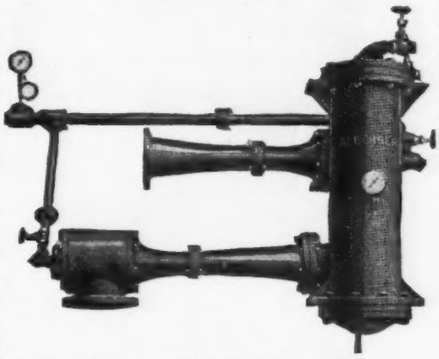
The installation of the two-speed gear box also makes a slip-ring induction motor suitable for stoker drive. A two-to-one reduction in speed is all that can be obtained electrically, but with the two-speed box an over-all range of speed of four to one is obtained.

Since all gear boxes are driven from one through shaft, all sprockets and chain connections, chain guards, countershafts and bearings usually required for each gear box are eliminated. Each stoker with the two-speed gear box has only one chain connection, saving a great deal of mechanism underneath the stoker with large units.

By using the two-speed gear box stokers can be set much lower than usual.

Air Occluders for Surface and Jet Condensers

Operating economy, low cost of upkeep and small space required are advantages which the air occluders made by the Alberger Pump & Condenser



EQUALLY APPLICABLE TO LAND INSTALLATIONS AND MARINE WORK

Company, 140 Cedar Street, New York City, for use with surface and jet condensers, are said to possess. Their high efficiency, low cost of attendance and repairs and freedom from breakdown are due to the absence of moving parts. On account of light weight, the small space occupied and simplicity of operation these occluders are particularly suited for marine work, although also applicable to land installations.

The apparatus consists of two stages arranged in series with an intercooler of either the surface or jet type placed between them. The first stage is connected to that part of the equipment from which the air and non-condensible vapors are to be removed and is so constructed that the entering steam entrains the air and non-condensible vapors and compresses them to the pressure existing in the intercooler. The mixture of steam and air and non-condensible vapors is then discharged into the intercooler, which by condensing the steam and cooling the air and non-condensible vapors reduces the volume to be handled by the second stage.

The second stage withdraws the gases from the intercooler and discharges them against atmospheric pressure or against a back pressure not to exceed 1 lb. 70 gm. per sq.cm. above atmospheric, permitting the use of exhaust steam for heating purposes.

Flatiron with Inclosed Heating-Coil Construction

The heating element in the domestic model 6-lb. (2.7-kg.) electric flatiron which has been lately placed on the market by the Simplex Electric Heat-

HEATING ELEMENT HELD WITHIN IRON BOTTOM CLOSE TO IRONING SURFACE

ing Company, 85 Sidney Street, Cambridge, Mass., is the same as those used in this company's ranges and other appliances requiring intense heat. Because of its inclosed coil construction the heating element is twice the length and diameter of the ordinary forms, with a corresponding increase in strength and life. Heavy chromium wire is suspended in grooves in the upper part of the flatiron bottom by small mica blocks. Since nothing but these occasional blocks touches the coil, and as no insulation is needed between the coil and the iron bottom, the chief cause of breakdown in electric irons is removed.

The iron has a highly polished nickel-plated surface, is rated at 570 watts, and is intended for voltages from 100 to 120.

NOTES ON RECENT APPLIANCES

Pliers with Replaceable Cutting Jaws

"Neverslip" pliers with replaceable crucible steel cutting jaws have been developed by the Neverslip Works of New Brunswick, N. J., for use by linemen, electricians, etc.

Mileage Recorder

For recording the mileage of electric and gasoline commercial and pleasure vehicles the H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City, has developed the "Odometer."

Combination Electric and Hand Air Pump

The Visible Measure Gasoline Dispenser Company, 715 West Breckinridge Street, Louisville, Ky., is making a combination electric and hand air pump for garages.

Cut-out Bases

Main-line and branch cut-out bases for NEC and renewable fuses have been brought out by the Economy Fuse & Manufacturing Company, Kinzie and Orleans Streets, Chicago.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired by a man in Belgium (No. 29,479) for the sale of all sorts of electrical goods and machinery.

The purchase of electrical supplies and lighting appliances is required by a firm in Norway (No. 29,494). Payment against documents at destination.

A firm in the Philippines (No. 29,517) having a branch office in this country desires to represent manufacturers for the sale of electrical appliances.

Electrical supplies of all kinds, transmission belting and electrical cables, etc., are desired by a firm in Norway (No. 29,452). Quotations should be given f.o.b. American port of shipment. Terms, cash against documents.

An official of the government of Siberia (No. 29,454) wishes to purchase for the ministry of supplies electrical supplies, a complete list of which together with further information may be had on application to the bureau or its district offices.

A Brazilian engineer (No. 29,478) who will be in the United States shortly desires to purchase materials for the construction of an electric lighting plant and an electric railway, electric railroad supplies, portable electric lighting plants, etc.

A firm in Spain (No. 29,346) desires to secure agencies on a commission basis for the sale of electrical material and apparatus, such as lamps, motors, fans, plates, stoves and water-heating apparatus. Correspondence should be in Spanish.

Resistance wire, covered wire and cables, motors and general electrical material and machinery for developing electric power are required by a firm in Spain (No. 29,453). Quotations should be given f. o. b. New York. Terms, payment in New York. Correspondence may be in English.

BRITISH IMPORT RESTRICTIONS RELIEVED.—The War Trade Board announces that copper wire and copper-clad wire may be imported into Great Britain without individual license.

COMMERCE WITH VENEZUELA. — During 1916 imports into Puerto Cabello, Venezuela, of electrical installation materials, amounted to $14,702, while for 1917 the amount increased to $26,154. This material came only from the United States. Considering the whole of Venezuela, the imports were as follows:

	1916	1917
Electrical apparatus	$152,739	$194,252
United States	133,892	188,568
United Kingdom	4,743	4,958
Electric lamps	.....	5,320
United States	.....	4,340
Electric light bulbs	10,601	36,519
United States	9,252	35,594

INDUSTRIAL MAP OF NEW ENGLAND.—The First National Bank of Boston, through its commercial service department, has published a very interesting industrial map of New England, showing by symbols and cuts the leading industries in the cities and towns. A key to the symbols is also included in the map which enables one to locate at a glance the various industries. There is also included a carefully worked-out table of the industrial towns arranged by states, and the leading industries in each city and town are shown. To further the development of foreign trade and to enable the foreign buyer to become familiar with the products which New England manufactures, this map will be published in other languages for distribution in the foreign markets of the world.

ROBBINS & MYERS TO EXPAND.—The Robbins & Myers Company has acquired 5½ acres of ground and all of the factory buildings of the James Leffel Water Wheel Company, adjoining the Robbins & Myers buildings at Springfield, Ohio. As soon as the Leffel company vacates the buildings Robbins & Myers will take possession and increase their force from 3000 to over 5000. Robbins & Myers acquire by purchase 98,000 sq.ft. of factory floor space and all the buildings, including the boiler shop, the erection room, foundry room, woodwork shop and office buildings, thus giving the concern all told approximately 500,000 sq.ft. of floor space over 14 acres of ground. It is reported that the increased factory facilities will mean material growth in the motor-manufacturing department of the company, development of new motors and expansion in the new line of repulsion and induction motors. The Robbins & Myers Company began business in 1878 under the ownership of Chandler Robbins and James A. Myers with a small casting foundry. In 1887 C. F. McGilvray, now president of the company, joined it as superintendent. In 1898 the concern entered the electrical field, producing ceiling fans and later desk and bracket types. Its first power motors followed in 1899. In 1900 Mr. Robbins' interests were purchased by James A. Myers. H. E. Myers resigned in 1915, when Mr. McGilvray became president. Starting in a small way, the firm has grown very rapidly until it now occupies a prominent position in the motor-manufacturing and fan field.

GENERAL ELECTRIC WAR SERVICE RECORD.—The enviable war record of General Electric employees at the Schenectady plant was summarized on a large display board located at the head of Works Avenue, Schenectady, to stimulate interest in the Victory loan. In effect, this display board is a large and handsome poster showing the complete war work of the Schenectady employees in the Liberty loan drives, the various fund campaigns and a record of local G. E. men in the army and navy service. Surmounted by the American eagle and the motto "The U. S. A. Our Country," this board shows the number of bonds sold in all the loan drives, including the record for the Victory loan. It gives the amounts raised for other campaigns, including war savings stamps. The total loans amount to $8,791,250 and the total war gifts to $339,313. The works honor roll contains 3278 names, and there are thirty-five gold stars on the works service flag. This bulletin board is in colors, with the emblem of various war relief organizations on either side, and is really a wonderful piece of work.

WAR WORK OF G. E. SCHENECTADY EMPLOYEES IN LIBERTY LOAN DRIVES

WESTINGHOUSE COMPANY TO BUILD SMALL MOTORS AND AUTOMOBILE EQUIPMENT AT SPRINGFIELD PLANT. —The Westinghouse Electric & Manufacturing Company has taken over the East Springfield (Mass.) plant of the New England Westinghouse Company and will manufacture fractional-horsepower motors and electrical equipment for automobiles at this noted establishment, which was active in rifle production for the Allies during the war. This announcement was made through the Springfield Chamber of Commerce and was followed by a luncheon at the Nyasset Club to A. B. Reynders, works manager, and Frank A. Merrick, manager of the factory during the war period. The ultimate capacity of the plant will be 30,000 automobile type generators and 15,000 small motors per month. It is expected that about 1000 employees will be at work at East Springfield by the end of this year, with an increase of about 2250 next year. The company plans to duplicate its output at Newark and may transfer its small-motor production from Newark during 1920, leaving the New Jersey factory to manufacture meters, as before the war. The estimated cost of machinery and equipment to be provided is $1,000,000. Manager Reynders has been with the Westinghouse company thirty years and was director of production at Pittsburgh until his selection as manager of the East Springfield factory. He is now in Springfield superintending the installation of machinery. The entire plant will be electrically driven. Mr. Merrick will henceforth devote his time to the management of the Canadian Westinghouse Company, Hamilton, Ont., having divided his time between that plant and East Springfield during the war period.

THE BLUEBIRD MANUFACTURING COMPANY is the new name for the National Tool & Manufacturing Company, 2536 University Street, St. Louis, Mo. Heretofore the company was engaged in the manufacture of tools, gages, fixtures, motion-picture machines, typewriting machines, specialties and ordnance material, but since the closing of the war it has developed a line of electrical household appliances and from now on intends to devote its efforts exclusively to these electrical products. Its line of goods is being marketed under the name of Bluebird, and the change in the incorporated title has been effected to identify it more closely with its product.

THE O. J. GUDE COMPANY, New York, now comprises the former O. J. Gude Company, the Poster Advertising Company and the Van Beuren Bill Poster Company. The former Gude company has been acquired by the Poster company. The new company occupies one-half the city block on Eleventh Avenue from Fifty-sixth to Fifty-seventh Streets, and the entire organization is under one roof—executive, sales, art, painting studios, electrical laboratories, construction and engineering departments, machine shops and garages. Kerwin Fulton is president of the new company, O. J. Gude is chairman of the board of directors, Irving Bromiley is general manager, Harold J. Mahin is general sales manager, and Clyde S. Thompson is promotion manager.

THE ALPHA ELECTRIC COMPANY, INC., 116-118 West Twenty-ninth Street, New York City, is about to move to 151-155 West Thirtieth Street, where the larger quarters will enable it to handle a rapidly growing jobbing business. Organized five years ago, the company has been consistently growing month after month, and during 1918 it trebled its business for 1917. James H. Hughes, general manager, has just returned from St. Louis, having secured for his company the agency for the Blue Bird electric washer. The territory embraced in the contract covers Greater New York, all of Long Island, the territory from New York City to Poughkeepsie, Port

Jervis, N. Y., Trenton, N. J., and Fairfield County, Conn. The company is preparing a plan to market this washer through the contractor-dealer and plans for him to sell machines on time payments.

F. C. ROBERTS is now sales manager of the Great West Electric Company, Winnipeg, Canada.

P. W. SOTHMAN is going to Copenhagen to take charge of the European office of P. W. Sothman & Company, engineers, 30 Church Street, New York City.

THE W. T. McCULLOUGH ELECTRIC COMPANY, electric supply jobber, Pittsburgh, Pa., has recently moved into new and larger quarters at 317-319 First Avenue.

THE WELLMAN-SEAVER-MORGAN COMPANY announces the opening of an Atlanta office at 318 Hurt Building, in charge of E. R. Kenner.

L. W. HENCH, formerly power sales engineer for the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, is now sales manager of the International Oxygen Company, Newark, N. J.

W. B. WALLIS, vice-president of W. E. Moore & Company, consulting steel engineers, of Pittsburgh, sailed on the Mauretania May 13 for Europe on an extended business trip. His firm has received a demand for electrical furnaces built under the Moore patents at the large industrial centers of the leading western European countries and these require personal attention. Electrical furnaces built under the Moore patent, known as the Pittsburgh furnace, are now in extensive use in the steel-mill districts.

W. B. WALLIS

THE EUREKA VACUUM CLEANER COMPANY of Detroit, Mich., began with May the publication of a monthly bulletin entitled "Volume and Velocity," which will be sent to dealers in vacuum cleaners. It is designed to promote the intelligent merchandising of this company's products.

JOHN F. VAUGHAN, formerly manager of the New England district, United States Shipping Board Emergency Fleet Corporation, has returned to his consulting engineering office at 185 Devonshire Street, Boston, which during the war has been in charge of his principal assistant, E. A. Ekern.

H. H. ASHINGER, formerly chief engineer of the George Cutter Company, has recently been appointed general manager of the Peru Electric Company, Peru, Ind., manufacturer of standard and special porcelain and wiring devices. An extension of factory space is contemplated by the company to take care of the manufacture of new developments.

J. W. McCABE, who until recently has been district manager of sales for the Chicago Pneumatic Tool Company at Buffalo, N. Y., has been appointed special representative for the company's foreign trade department, and will depart shortly for an extended trip throughout the Orient, the Philippine Islands and Australia. W. H. White has been appointed acting district manager of sales at Buffalo to take charge of that territory during Mr. McCabe's absence.

Trade Publications

ELECTRIC RANGES.—An electric range folder for mailing to retail "prospects" has been prepared for the trade by the Simplex Electric Heating Company, 85 Sidney Street, Cambridge, Mass.

ELECTRICALLY HEATED HOUSEHOLD UTENSILS.—The Manning, Bowman Company of Meriden, Conn., has prepared a folder telling about its electrically heated household utensils.

OUTDOOR BUS SUPPORTS.—Hickey & Schneider, Inc., 441 East Jersey Street, Elizabeth, N. J., are distributing bulletin No. 13, of forty-eight pages, which covers H. & S. outdoor-type bus supports.

EXTERNALLY OPERATED ENTRANCE SWITCHES.—The Trumbull Electric Manufacturing Company of Plainville, Conn., tells of one of its externally operated entrance switches in circular No. 44.

WOOD PRESERVATIVE.—The Carbolineum Wood Preserving Company, 518 Prairie Street, Milwaukee, Wis., has prepared circulars No. 29 and 39, telling about the "Arrow" carbolineum wood preservative.

MEASURING INSTRUMENTS. — The Thompson-Levering Company, 325 Arch Street, Philadelphia, has issued a forty-page bulletin, No. 119, to describe and illustrate its electrical measuring instruments.

HIGH-SPEED STEEL.—The properties, manufacture and treatment of "Urite" high-speed steel are set forth in a booklet which the Hercules Electric Steel Corporation, 137 Lafayette Street, New York City, is distributing.

FLOOR MACHINE.—The Kent Vacuum Cleaner Company of Rome, N. Y., has prepared a booklet giving instruction for assembling and also for using the electrically driven "Utility" floor scrubbing and polishing machine.

CONDENSERS AND AUXILIARIES.—An illustrated booklet of 191 pages has been prepared by the C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, to describe its condensers and auxiliaries.

METER PROTECTIVE TRIM. — The "Standard" meter protective trim for use with externally operated entrance switches is the subject of circular No. 45 issued by the Trumbull Electric Manufacturing Company, Plainville, Conn.

BLACK ENAMELS AND JAPANS.—A third revised edition of bulletin No. 1 on "Hilo" black enamels and varnishes for air drying and baking has been issued by the Hilo Varnish Corporation, Marcy and Flushing Avenues, Brooklyn, N. Y.

SUPERHEATER.—The Locomotive Superheater Company of 30 Church Street, New York City, and People's Gas Building, Chicago, has prepared an eight-page bulletin T-2, which sets forth the advantages of the Elesco stationary superheater.

DYNAMOMETERS. — Superseding bulletin No. 78,701, bulletin No. 48701-A has been issued by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City, and covers Sprague electric dynamometers.

PORTABLE LAMPS, LANTERNS, FIXTURES, ETC.—The Novelty Lamp & Shade Company, 418 West Prospect Street, Cleveland, Ohio, has prepared catalog No. 34, illustrating and describing portable lamps, lanterns, brackets, pendants, porch lights, billiard lights and semi-direct lighting bowls.

OVERHEAD MATERIAL HANDLING.—Bulletin No. 48,713 from the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City, has for its subject the Sprague adjustable-loop system of overhead material-handling machinery for terminal sheds.

ELECTRICALLY HEATED MELTING POTS.—"Melting Metal with Electrically Heated Pots" is the title of a six-page envelope folder just published by the Cutler-Hammer Manufacturing Company of Milwaukee and New York. This folder calls attention to the advantages of electrically heated melting pots over gas and gasoline.

ELECTRIC SIGNS.—A number of interior-illuminated electric signs are shown in a circular from the Flexlume Sign Company of Buffalo, N. Y.

BORING TOOLS.—Boring machines and bits for electricians are the subject of a folder from the W. A. Ives Manufacturing Company, Wallingford, Conn.

METER BOX.—The Electrical Manufacturing Company, 4149 East Seventy-ninth Street, Cleveland, Ohio, is distributing a folder telling about its safety meter box.

BUCKET ELEVATORS. — Standard bucket elevators are described and illustrated in a seventy-one-page catalog, No. 244, issued by the Jeffrey Manufacturing Company of Columbus, Ohio.

New Incorporations

THE GAINADAY ELECTRIC COMPANY of Dormont, Pa., has been incorporated by Charles B. Barton and associates. The company is capitalized at $50,000 and proposes to manufacture electrical appliances, etc.

THE ADJUSTABLE DROPLIGHT COMPANY of New York, N. Y., has been chartered with a capital stock of $25,000 to manufacture electric devices and supplies. The incorporators are: R. K. Thistle, S. B. Howard and P. L. Nieser, 65 Cedar Street.

THE CUTTING & WASHINGTON RADIO CORPORATION of New York, N. Y., has been incorporated with a capital stock of $36,750 to manufacture radio equipment. The incorporators are W. C. Schmidt, F. and R. F. Cutting, 32 Nassau Street, New York City.

THE WELLAND (ONT.) UTILITY MANUFACTURING COMPANY has been incorporated by George A. Mitchell, Charles B. Wilson, Arthur J. J. Brennan and others. The company is capitalized at $250,000 and proposes to manufacture electrical appliances, tools, machinery, etc.

THE ELECTRIC LOCK CORPORATION of New York, N. Y., has been chartered with a capital stock of $200,000 to manufacture electric motors, dynamos, electric machinery, etc. The incorporators are C. A. Jayne, A. F. Reed and P. M. Freeman, 81 Fulton Street, New York City.

THE CRESCENT ELECTRIC SUPPLY COMPANY of Dubuque, Iowa, has been incorporated by Titus B. Schmid, T. F. Kelley and A. J. Schmid. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical supplies, wiring fixtures, hardware, etc.

THE COMMERCIAL RADIO COMPANY OF AMERICA of Providence, R. I., has been chartered with a capital stock of $100,000 by Frank E. Dyson, 43 Pakis Avenue; Ratcliffe G. E. Hicks and Thomas P. Giblin of Providence. The company proposes to manufacture wireless apparatus.

THE UNIVERSAL X-RAY LABORATORIES of New York, N. Y., has been incorporated by B. H. Bernstein, R. Seixas and L. Robbins, 1476 Broadway, New York City. The company is capitalized at $30,000 and proposes to maintain X-ray laboratory service for physicians.

THE VICTORIA TURBINE MIXER COMPANY of Toronto, Ont., has been incorporated by Walter A. Sadler, 67 Yonge Street; Charles A. Couch, George Stevenson and others. The company is capitalized at $100,000 and proposes to manufacture gasoline-saving devices, electrical and mechanical equipment, etc.

MEYER, STRONG & JONES, INC., of New York, N. Y., have filed articles of incorporation with a capital stock of $50,500 for the purpose of doing a general contracting, mechanical, civil and electrical engineering business. The incorporators are: Schuyler M. Meyer, John L. Dunn and L. H. Hoheim, 20 Exchange Place, New York, N. Y.

THE RAYDEX MANUFACTURING COMPANY of Brackenridge, Pa., has been incorporated by W. F. Detweiler of Trentum, Charles C. Henderson of Aspinwall, Paul A. Stewart of Cheswick, George M. Swan and John R. Rosenbaum of Pittsburgh. The company is capitalized at $150,000 and proposes to manufacture metal furniture, electrical devices, etc.

New England States

BANGOR, ME.—Improvements are contemplated by the Bangor Railway & Electric Company at both the Ellsworth and Veazie power stations, and also for the reconstruction and reinsulation of the feed wires between the two stations. At the Ellsworth station a 25,000-kw. generating unit is to be installed and at the Veazie station three high-efficiency waterwheels will replace the old wheels now in use.

SWANTON, VT.—At a town meeting held recently the trustees were authorized to enter into a contract with the Wallace Sandstone Company of Phillipsburg, Que., for electric power. The transmission line will be erected as soon as possible via Highgate Springs to the international boundary.

Middle Atlantic States

FORESTPORT, N. Y.—Preparations are being made by the Board of Village Trustees for the construction of a new electric light plant.

GLENS FALLS, N. Y.—The Council is considering a proposal submitted by the Adirondack Electric Power Corporation for the installation of an ornamental lighting system in the business section of the city. The cost is estimated at about $10,000.

GREENWICH, N. Y.—The Consolidated Electric Company is reported to be contemplating an addition to its plant. Harry C. Gray is manager.

HADLEY, N. Y.—The plant of the Hadley Lighting Company was recently sold to John Gatti of New York City for $3,025.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until July 1, for construction, including heating, sanitary and electrical work, for new building for chronic patients at the Middletown State Homeopathic Hospital. Drawings and specifications may be seen at the above institution, or at the office of the New York office of the Department of Architecture, Room 618, Hall of Records Buidling, New York City. Copies of plans and specifications may be obtained at the Department of Architecture, Capitol, Albany. L. F. Pilcher is state architect.

NEW YORK, N. Y.—The Wappler Electric Company, 173 East Eighty-seventh Street, New York City, has acquired a site on Harris Avenue, Long Island City, on which it proposes to erect a three-story plant. R. H. Wappler is president.

NEW YORK, N. Y.—A special committee has been appointed by Jefferson De Mont Thompson, president of the Broadway Association, to investigate and make recommendations for improving the lighting system on Broadway. A. F. Berry of the United Electric Light & Power Company and Charles Law of the New York Edison Company are among the members of the committee.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3933, for the installation of electric traveling cranes at the local navy yard. The cost is estimated at about $200,000. Bids will also be received at the same time and place for elevators for building at the shipbuilding way, No. 1, under Specification 3934. The cost is estimated at $15,000.

SARATOGA SPRINGS, N. Y.—A committee consisting of two representatives of the City Council, Chamber of Commerce, Business Men's Association and the Adirondack Electric Power Corporation has been appointed to make investigations relative to the installation of a new lighting system on Broadway and in the city parks.

NEWARK, N. J.—Contract has been awarded by the American Oil & Supply Company, Lafayette Street, to the K-W Electric Company, 49 Lawrence Street, for electrical work in connection with the construction of the group of manufacturing buildings which are now being built on Wilson Avenue.

BETHLEHEM, PA.—Bids will be received by the Bureau of Water until June 23 for furnishing and installing a 2,000,000-gal. electrically driven centrifugal pump. R. L. Fox is city engineer.

LACKAWANNA, PA.—Bids will be received by the Common Council of the city of Lackawanna until June 16 for material and supplies for equipping the pumping station for electrical operation. Plans and specifications may be obtained on aplication to the Commissioner of Public Works.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MYERSTOWN, PA.—Preliminary plans are being prepared for the construction of a new power plant in connection with a number of new buildings at the Albright College. The cost of the entire work is estimated at about $200,000.

CREAGERSTOWN, MD.—The citizens of Creagerstown have contracted with the Hagerstown & Frederick Railway Company of Hagerstown for the installation of an electric lighting system. The cable of the company will be tapped at Lewistown and energy will be transmitted over a 4-mile transmission line. Funds to the amount of $4,200 have been subscribed to erect the line. Creagerstown has not a post office.

INDIANHEAD, MD.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning the construction of a power plant, to cost about $200,000, at Indianhead. (Specification 3924.)

WARWOOD, W. VA.—The Highglow District Electric Sign Company is planning to convert an air-craft plant into an electrical sign factory.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 1, for supplying to the various federal buildings, marine hospitals and quarantine stations under the control of the Treasury Department portable desk lamps during the fiscal year ending June 30, 1920. Drawings and specifications may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until June 20, various yards, under Schedule 4102, dry cells. Until June 24, various yards, Schedule 4109, miscellaneous flashlights and batteries. Until June 27, South Charleston, W. Va., Schedule 4098, three electric locomotives, rack drive. Hampton Roads, Va., Schedule 4115, one motor-generator set. Until July 1, Boston, Mass., Schedule 4122, twenty brass-melting furnaces. Applications for proposal blanks should designate the schedule desired by number.

North Central States

CEDAR BANK (Forsyth P. O.), MICH.—The State Board of Control is considering the erection of a State Training School at Cedar Bank, to cost about $500,000. The plans provide for an administration building, three dormitories and central heating plant. B. Wickham is secretary. E. A. Bowd, 127 Allegan Street, West, Lansing, is architect.

DETROIT, MICH.—The National Biscuit Company, Tenth Avenue and Fifteenth Street, New York, N. Y., is planning to erect a power plant in connection with its new buildings in Detroit.

DETROIT, MICH.—The Mutual Electric & Machine Company of Detroit has purchased the building at the corner of Fourth and Porter Streets. Extensions and alterations will be made to provide for a floor space of about 100,000 sq.ft. J. L. Frank is president.

PLAINWELL, MICH.—The local plant of the Consumers' Power Company, it is reported, was recently destroyed by fire, causing a loss of about $25,000.

ST. LOUIS, MICH.—Improvements to the municipal electric light plant, to cost about $40,000, are under consideration by the Electric Light and Water Commissioners.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has petitioned the Public Utilities Commission for permission to issue $6,708,000 in bonds. Part of the proceeds, it is understood, will be used for extensions and improvements.

CINCINNATI, OHIO.—The extension of the ornamental lighting system on Vine Street to cover the entire down-town section of the city and to the suburbs is under consideration by the City Council.

CINCINNATI, OHIO.—Bids will be received at the United States Engineer Office, First District, Cincinnati, until July 8 for furnishing gate-operating machinery for dams Nos. 33 and 39, Ohio River.

CINCINNATI, OHIO.—The City Council has adopted the resolution authorizing the installation of new ornamental lamps on McMillan Street, which is one of the main thoroughfares of the suburban section of the city and the first to be equipped with ornamental lamps.

CINCINNATI, OHIO.—Work will soon be started on the proposed rapid transit loop system, which will consist of a series of rapid-transit lines that will completely encircle the city. The old Miami & Erie Canal bed is to be utilized as a roadway for part of the system. Frank Krug is chief engineer of the commission.

CLEVELAND, OHIO. — The Leonard Electric Company, 433 Champlain Avenue, Cleveland, is planning to erect a new plant, 85 ft. by 115 ft.

CLEVELAND, OHIO. — Contract has been placed by the Ohio Electric & Controller Company, 5800 Maurice Avenue, for the construction of a new plant, two stories, 80 ft. by 100 ft.

LIMA, OHIO.—The Ohio Electric Railway Company is considering improvements to its local plant, involving an expenditure of about $200,000. The company is also planning to build within the next five years either at Indian Lake or Scotts Crossing a power plant to cost about $2,000,000.

MANSFIELD, OHIO.—Contract has been awarded by the Triumph Electric & Ice Machine Company for the erection of a plant, 60 ft. by 80 ft.

SHELBY, OHIO.—The Seamless Tube Company is considering the purchase of new equipment for power plant, including generators, etc., and also equipment for machine shop. G. L. Richert is secretary.

SPRINGFIELD, OHIO.—The Robbins & Myers Company has purchased the manufacturing plant of the James Leffel Company, which will be remodeled for the manufacture of electric fans and motors.

WELLINGTON, OHIO.—An election will soon be called to submit to the voters the proposal to issue $50,000 in bonds for extensions and improvements to the municipal electric light and water plant.

EVANSVILLE, IND. — Extensive improvements are being made by the Louisville & Nashville Railroad Company at its shops in Lowell, a suburb of Evansville, including the installation of an electric turntable and an automatic coaling plant. A new roundhouse will be erected later.

WANATAH, IND.—The caiptal stock of the Wanatah Electric Company has been increased from $5,000 to $10,000.

CHICAGO, ILL.—The Iron Mountain Company, recently organized, has purchased a tract of land in East Ninety-fifth Street, on which it will erect a plant, to cost about $250,000. The first unit will cost about $150,000 and will be equipped with electric cranes. The company will manufacture railroad supplies.

CHICAGO, ILL.—The officials of the Illinois Central Railroad Company have agreed with the Chicago Commission on Railway Terminals and a sub-committee of the City Council to a fifteen-year electrification provision being written into the proposed ordinance for the improvement of the south shore. Under the arrangement the company agrees to have its suburban service equipped for electrical operation within five years after the passage of the proposed ordinance; the next five years to equip the freight service north of Twelfth Street, and in the next five years to equip the balance of the freight service south of Twelfth Street for electrical operation.

DECATUR, ILL.—Contract will soon be awarded by the Comet Automobile Company for the construction of an electric power plant, to cost between $60,000 and $70,000. The proposed plant will have an output of 600 hp. and will supply electricity for the automobile works. George W. Jagers is president.

DELAVAN, ILL.—Preparations are being made by the Royal Light & Power Company to erect a 6600-volt transmission line from the new power house at San José to Delavan. When completed the local power plant of the company will be held for use in emergencies. A twenty-four-hour service will be established by the company when the improvements are completed.

GALESBURG, ILL.—Bids will be received by William L. Boutelle, city clerk, Galesburg, until June 16 for one 30-hp., 220-volt, three-phase, slip-ring-type motor, 1800 r.p.m.; three 40-hp. 220-volt, three-phase, 60-cycle, slip-ring-type motors, 1800 r.p.m.; three 600-gal.-per-minute, motor-driven centrifugal pumps, directly con-

nected, working under discharge pressure of 60 lb. Specifications may be obtained at the office of F. M. Connolly, city engineer.

PALMYRA, ILL.—The Palmyra Light, Heat & Power Company has applied to the Public Utilities Commission for permission to erect and operate an electric transmission line from Palmyra to Waverly; also to build distribution system in the village of Modesto and to supply electrical service in those villages.

ROCK ISLAND, ILL.—The City Council is considering installing Mazda lamps to take the place of 100 arc lamps. Street-lighting service is furnished by the People's Power Company of Moline.

SPRINGFIELD, ILL.—The amended budget of the city provides $50,000 for the municipal electric light plant. Extensions and improvements will be made to the system.

MANITOWOC, WIS.—The Commissioners of Manitowoc are contemplating the installation of street lamps in conjunction with the street-lighting system on South Eighth Street.

SHEBOYGAN, WIS.—The Honold Electric Company, 819 Pennsylvania Avenue, is planning to erect an addition to its plant, to be used for repair and maintenance of storage batteries and automotive electrical devices.

ELY, MINN.—The Council is considering issuing $66,000 in bonds for improvements to the municipal electric light plant and waterworks system.

MONTEVIDEO, MINN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 9 for furnishing material for construction, including structural steel, plumbing, heating, electrical work, etc., for the United States post office at Montevideo. Specifications may be obtained at the above office or from the custodian of site at Montevideo.

CENTERVILLE, IOWA.—The property of the Iowa Southern Utilities Company has been purchased by David C. Fisher & Company of Davenport. The system is valued at $2,500,000 and operates 33 miles of interurban railway and lighting plants in twenty-five towns.

MONDAMIN, IOWA — Arrangements have been made by local business men for the installation of an electric lighting system. Energy to operate the proposed system will be supplied from the plant at Missouri Valley.

CARTHAGE, MO.—The Council is considering the installation of cluster lamps on all paved streets.

FULTON, MO.—A special election will be held June 17 to submit to the voters the proposal to issue $50,000 in bonds for the installation of a municipal telephone system.

KANSAS CITY, MO.—Morris & Company of Chicago, Ill., are contemplating increasing the output of the power plant at its local works.

ST. JOSEPH, MO.—Improvements will be made to the local packing plant of Morris & Company of Chicago, Ill., including the installation of a 300-ton ice machine and other machinery, rebuilding the water condenser, etc.

ST. LOUIS, MO.—The Weber Implement & Automobile Company is planning to build a garage and rebuidling plant, to cost, including equipment, about $350,000.

SPRINGFIELD, MO.—Plans are being prepared by the Springfield Gas & Electric Company for the construction of a new electric power plant, to cost about $750,000.

NORMAL, NEB.—The power plant at the Green Gables Sanitarium was recently destroyed by fire.

PHILLIPS, NEB.—At an election held recently bonds were authorized for the erection of an electric transmission line from the transmission system of the Grand Island Power Company to Phillips.

EASTON, KAN.—Improvements to the municipal electric light plant are under consideration.

GYPSUM, KAN.—The Central Kansas Power Company is contemplating the construction of a large power plant on the western end of its transmission system. R. O. Keys is president of the company.

HUTCHINSON, KAN.—The Hugoton Elevator & Warehouse Company is planning to erect a terminal elevator, to be operated by electricity supplied by the company's own plant.

HUTCHINSON, KAN.—The United Water, Gas & Electric Company is contemplating the erection of an electric transmission line from Hutchinson to Partridge, Arlington, Langdon and Turon, to supply electrical service in those towns. J. F. Spingfield is general manager.

KANSAS CITY, KAN.—Bids will be received by the city of Kansas City until June 18 for equipment for the Quindaro pumping station, including auto stokers for two 600-hp. boilers, one steam-turbine-driven boiler-feed pump, steam turbo-generator and condensing apparatus, two 600-hp. boilers and steam superheaters, 1,000,000-circ-mil stranded copper cable, 3000 volts pressure; miscellaneous cedar poles, insulators, wire braces, etc., and erection of a brick transformer station. William Barclay is engineer.

Southern States

CORNELIUS, N. C.—The City Council is considering an issue of $6,000 in bonds for the installation of an electric lighting system in Cornelius.

WILMINGTON, N. C.—Plans are under consideration by the Morris Fertilizer Company, Third National Bank Building, Atlanta, Ga., for the construction of a fertilizer plant on the Cape Fear River, near Wilmington. The proposed plant will have a capacity of about 75,000 tons per year. The cost of the plant complete, including an electrically operated industrial railway system, is estimated at about $500,000.

SPRINGFIELD, GA.—The local electric light plant, which was recently destroyed by fire, it is reported, will be rebuilt.

BOWLING GREEN, FLA.—The City Council has called an election to submit to the voters the proposal to issue $20,000 in bonds for the construction of an electric distributing system and waterworks system.

FITZGERALD, FLA.—Improvements to the municipal electric light and power plant are under consideration by the City Council.

COLDWATER, MISS.—The installation of an electric lighting system, to cost about $10,000, is under consideration by the City Council.

HARRISON, ARK.—The electric plant of the Harrison Gas & Electric Company was damaged by the recent flood.

MARIANNA, ARK.—Improvements are contemplated by the Arkansas Light & Power Company to its local plant, including the installation of a 250-hp. boiler-feed pump, repairs to switchboard and other equipment.

PARIS, ARK.—The City Commissioners are considering plans to establish a municipal electric light plant in Paris.

GARBER, OKLA.—Plans have been prepared by Black & Veatch, Interstate Bank Building, Kansas City, Mo., for the installation of a municipal electric light plant and waterworks system.

LAWTON, OKLA.—Arrangements have been made whereby the Lawton Railway & Lighting Company will secure power after July 1 for operating its system from the Comanche Light & Power Company of Lawton. The plant of the railway company, it is understood, will be closed down. New equipment, including a 250-kw. synchronous motor-generator set, will be installed by the Comanche company.

PERRY, OKLA.—Plans are being prepared by Black & Veatch, Interstate Building, Kansas City, Mo., for improvements to the municipal electric light and water plant.

SULPHUR, OKLA.—The Citizens' Light Company is planning to erect a new electric light plant and ice factory. Paul G. Liebman is manager.

TAHLEQUAH, OKLA.—Bonds to the amount of $200,000 have been voted to establish a municipal electric light plant and waterworks system.

BLOOMBURG, TEX.—The installation of an electric light plant in Bloomburg is under consideration by the City Commissioners.

BROWNSVILLE, TEX.—Contract, it is understood, will soon be awarded for the installation of new condensing apparatus, to cost about $10,000, for the municipal electric light plant. The Council has recently placed a contract with the Southwestern General Electric Company of Dallas for a 500-kw. turbo-generator.

DALLAS, TEX.—The Dallas Power & Light Company has applied for permission to issue $1,500,000 in capital stock and $6,000,000 in bonds to take up outstanding indebtedness and to provide for improvements and extensions.

DONNA, TEX.—The Donna Light, Ice & Power Company is contemplating making improvements to its system. The capital stock of the company has been increased from $5,000 to $10,000.

FORT WORTH, TEX.—The Fort Worth-Mineral Wells Interurban Association has engaged Fred A. Jones, engineer, Dallas, to make a survey of the proposed interurban railway between Fort Worth and Mineral Wells, a distance of 60 miles.

SHERMAN, TEX.—Plans are being considered to build a power plant to supply electricity to both Sherman and Denison. The proposition, it is expected, will be voted on soon.

WICHITA FALLS, TEX.—The Chamber of Commerce is considering the proposition of constructing an interurban railway between Wichita Falls and Burkbernett. Electricity for operating the proposed railway will be obtained from the Texas Light & Power Company.

Pacific and Mountain States

SEATTLE, WASH.—The City Council has directed the Board of Public Works to prepare plans for the installation of an additional hydroelectric unit of 10,000 hp. at the Cedar Lake municipal power plant.

BEND, ORE.—Owing to the fact that the entire flow of the Deschutes River at Benham Falls has been tied up by the State of Oregon, at the direction of the federal government, for power purposes and irrigation, it will not be possible for the Bend Water, Light & Power Company to carry out its plans for construction of a large plant near Lava Falls, above Bend.

NORTH BEND, ORE.—The Buehner Lumber Company is contemplating the purchase of a 500-kw. to 750-kw., 60-cycle, three-phase, 440-volt generating unit. A low-pressure or high-pressure turbine could be used, but the company prefers a surface condenser.

DEL MONTE, CAL.—The State Railroad Commission has granted the Del Monte Light & Power Company permission to issue $25,000 in stock to acquire the transmission line and distribution system of the Pacific Improvement Company.

LOS ANGELES, CAL.—At an election held June 3 the proposal to purchase the distributing system of the Southern California Edison Company within the city limits, for $11,000,000, was carried.

LOS ANGELES, CAL.—The Southern California Edison Company has completed the purchase of what is known as the Shaver Lake property on the San Joaquin watershed of central California in the Sierra Mountains at an elevation of approximately 6000 ft. above the sea level. It is proposed to construct a dam and the necessary tunnels to connect this reservoir with its existing power plant No. 2 on Big Creek, which will result in a substantial increased output of the plant without any additional generating units. The water supply will also be available for proposed power plants Nos. 3 and 4 on Big Creek, below the two existing plants. Eventually the water will be used by three power plants with a total drop of 4000 ft.

SAN DIEGO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3921, for construction of distributing system at the local navy yard, to cost about $58,000.

GRACE, IDAHO—Bonds to the amount of $15,000 have been voted for the purchase of the local lighting system.

MESA, ARIZ.—The City Council has decided to call an election to vote on the proposal to issue $100,000 in bonds for municipal improvements, including gas plant, installation of additional equipment in the municipal electric light plant and extensions to power service and improvements to water system, etc.

YUMA, ARIZ.—The Southern Sierras Power Company of Denver, Col., has entererd into a contract with the Sanguinetti & Ewing Company for the extension of its electric transmission system to the irrigated districts in this section to supply energy to operate the pumping plants and for farming operations. About 20,000 acres of land will be added to the irrigation system in addition to the area now being watered from the pumping plants.

PINE BLUFF, WYO.—Bonds to the amount of $40,000 have been voted for extensions to electric light plant, water mains and sewers.

GROVE, COL.—Bonds to the amount of $34,000 have been voted for the installation of an electric light plant and waterworks system.

SANTA FE, N. M.—A committee has been appointed by the council to negotiate with the Santa Fe Water & Light Company relating to the purchase of its plant and to appoint an engineer to appraise the property.

Canada

VANCOUVER, B. C.—The Lang Electrical Fixture Company of Vancouver has been awarded the contract for electrical work in connection with the new plant under construction by the Morrison Wire & Steel Company on Industrial Island.

ROBERVAL, QUE.—Improvements are contemplated to the municipal hydroelectric plant to cost about $20,000. New equipment includes a 300-hp. horizontal-shaft turbine, 50-ft. head, speed 600 r.p.m.; one 250-kva. alternating-current generator, exciter and switchboard. J. F. Trenton of Chicoutimi is engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until June 26 for scrap-cutting machine, copper wire and cable solder, dry batteries, reflectors, sockets, condulet covers, lamp carbons, tape, fuses, etc. Further information relating to this circular (1284) may be obtained at the above office.

Record of Electrical Patents

Notes on United States Patents

(Issued May 27, 1919)

1,304,534. CABLE SPLICE; Newton K. Bowman, Canton, Ohio. App. filed April 6, 1918. Has gripping spurs.

1,304,545. ELECTRIC SOLDERING DEVICE; Frederick A. Costello, Southbridge, Mass. App. filed Oct. 2, 1918. Tubular holder.

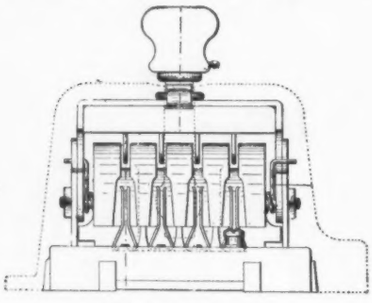
1,304,564. ELECTRIC SWITCH; Ellsworth A. Hawthorne, Bridgeport, Conn. App. filed Sept. 24, 1913. Rotary snap type.

1,304,573. ELECTRICAL DIRECTION INDICATOR; Hosaku Kageyama, Los Angeles, Cal. App. filed Sept. 30, 1914.

1,304,588. TRAY FOR BATTERY CELLS; James F. Monahan, Newark, N. J. App. filed Nov. 30, 1915. Alkaline cells.

1,304,594. ELECTRIC SEAM-WELDING DEVICE; Walter A. Patscheider, Lynn, Mass. App. filed Oct. 29, 1918. Means for clamping seam to work.

1,304,624. ELECTRIC HEATING APPARATUS; John P. Sunderland, Albany, N. Y. App. filed Aug. 1, 1917. Long rivets.



1,304,655—Switch

1,304,625. PROCESS OF RIVETING; John P. Sunderland, Albany, N. Y. App. filed Aug. 1, 1917. Electrical.

1,304,626. ELECTRIC HEATING APPARATUS; John P. Sunderland, Albany, N. Y. App. filed Aug. 1, 1917. Rivets.

1,304,634. ELECTRIC METAL-WORKING MACHINE; Edmund Jannez von Henke, New York, N. Y. App. filed Oct. 28, 1918. Electric welding.

1,304,641. CALL-DISTRIBUTING SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed July 1, 1916.

1,304,655. SWITCH; Frank Buchanan, Syracuse, N. Y. App. filed June 5, 1915. Means for shielding terminals.

1,304,687. ELECTRIC HEATER; Bertrand B. Kahn, Cincinnati, Ohio. App. filed July 25, 1918. Radiant.

1,304,703. ELECTRIC SEAM-WELDING APPARATUS; Lindley G. Palmer, Cincinnati, Ohio. App. filed Oct. 24, 1918. Maintains a constant difference of potential across the electrodes.

1,304,718. HOLDER FOR TELEPHONE RECEIVERS; Katharine G. Townsend, New York, N. Y. App. filed Aug. 31, 1918.

1,304,782. MAGNETO; Arthur C. Klecker and Walter Brown, Racine, Wis. App. filed Jan. 17, 1919.

1,304,786. APPARATUS FOR SEPARATING LIQUIDS IN EMULSION; Charles W. McKibben, Houston, Tex. App. filed July 26, 1918. Water from crude oil.

1,304,798. SAFETY APPARATUS FOR ELEVATORS; John Mutton, Cleveland, Ohio. App. filed Nov. 22, 1915. Car moved only when gates are closed.

1,304,823. APPARATUS FOR ELECTRICAL FIXATION OF GASES; Bruno Thomas, Seattle, Wash. App. filed April 18, 1917.

1,304,837. CIRCUIT BREAKER; Leo J. Werner, Arlington, N. J. App. filed Nov. 16, 1918. Magneto.

1,304,852. STORAGE-BATTERY PLATE AND PROCESS OF TREATING SAME; Rufus N. Chamberlain, Chicago, Ill. App. filed May 13, 1916. Negative.

1,304,856. COMBINED FLASHLIGHT AND MIRROR; Carl W. Dalberg, Deary, Idaho. App. filed June 10, 1918. Pocket flashlight.

1,304,868. WIRELESS-TELEGRAPH TRANSMITTER; Charles S. Franklin, London, Eng. App. filed Feb. 26, 1919.

1,304,894. AUTOMATIC STORAGE-BATTERY FILLER; Oscar P. Liebreich, Troy, N. Y. App. filed Jan. 17, 1918. Automobile.

1,304,896. GASOLINE HEATER; Harry E. McLaughlin, Lincoln, Neb. App. filed May 3, 1917. For carburetors.

1,304,925. SWITCH CONSTRUCTION FOR LANTERNS; Homer A. Woods, Indianapolis, Ind. App. filed Nov. 29, 1915. Switch always makes positive contact.

1,304,934. LIGHTING SYSTEM; Joseph Bijur, New York, N. Y. App. filed Dec. 21, 1910. Automobiles.

1,304,936. SIGNALING DEVICE; Charles H. Boardman, Vivian, West Va. App. filed April 9, 1915. Ventilating systems of mines.

1,304,957. POLYPHASE MOTOR; Valere A. Fynn, St. Louis, Mo. App. filed Feb. 3, 1917. Part of energy required conveyed by static induction.

1,304,958. DYNAMO-ELECTRIC MACHINE; Valere A. Fynn, St. Louis, Mo. App. filed May 28, 1917. Neutralized series conduction motors.

1,304,968. SIGNALING DEVICE; Clarence B. Harlow, Chicago, Ill. App. filed May 7, 1917. Diaphragm actuated by electromagnet.

1,305,011. REGULATING COMMUTATOR MACHINES; Reinhold Ruedenberg, Berlin-Charlottenburg, Germany. App. filed Jan. 28, 1914. Speed regulation and phase compensation.

1,305,013. AUTOMATIC REVERSING SWITCH; Henry K. Sandell, Chicago, Ill. App. filed Dec. 22, 1917. Music-sheet feeders.

1,305,015. ELECTRIC SYSTEM; Francis H. Shepard, New Rochelle, N. Y. App. filed July 24, 1914. For signaling to operators of electric railway trains.

1,305,031. ELECTRICAL REGULATING SYSTEM; Allen A. Tirrill, Pittsburgh, Pa. App. filed May 6, 1915. Maintains the speed of a motor uniform.

1,305,039. WELDING MACHINE; Robert E. Wagner, Pittsfield, Mass. App. filed Dec. 24, 1917. Electrode feed is effected by inclination of a bar supporting the welding electrode.

1,305,044. SYSTEM OF CONTROL; Charles App. filed April 5, 1917. Regenerative C. Whittaker, Wilkinsburg, Pa. App. filed April 5, 1917. Regenerative control of electric vehicle motors.

1,305,057. ELECTRICAL PROTECTIVE DEVICE; Addison E. Boggs, Pittsburgh, Pa. App. filed Feb. 4, 1916. Multivoltage distribution systems.

1,305,078. ELECTRIC RIVETING; Frank L. Dyer, Montclair, N. J. App. filed Aug. 16, 1918. Riveting operation performed before the blank cools.

1,305,084. SECONDARY OR STORAGE BATTERY; Louis H. Flanders, Jenkintown, Pa. App. filed Sept. 29, 1917. Insures alignment.

1,305,093. DISTRIBUTER; Paul C. Haas, Ann Arbor, Mich. App. filed May 2, 1918. Internal-combustion engines.

1,305,094. CENTRIFUGAL STARTING SWITCH; John B. Hansell, Sutton, Thirsk, Eng. App. filed Sept. 25, 1914. Cuts out the starting winding of single-phase motors.

1,305,104. ANTENNA FOR WIRELESS DISTRIBUTION SYSTEMS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed Aug. 12, 1916.

1,305,122. LAMP-SUPPORTING DEVICE; Max Kossmann, Brooklyn, N. Y. App. filed Oct. 30, 1918. Detachably secures lamps to vase.

1,305,126. SWITCHBOARD APPARATUS; Benjamin G. Lamme, Pittsburgh, Pa. App. filed April 29, 1915. Prevents arc from pumping.

1,305,130. GUARD FOR ELECTRIC HEATERS; Richard G. Ledig and Nikolaus Gerson, Philadelphia, Pa. App. filed Jan. 18, 1919. Series of arms.

1,305,136. MOTOR VEHICLE; Allen Loomis, Detroit, Mich. App. filed June 24, 1912.

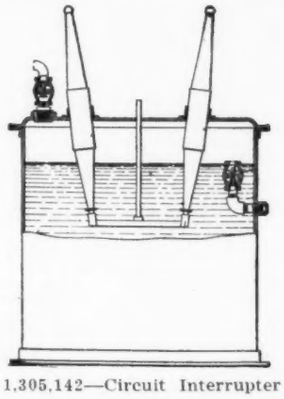
1,305,140. IGNITION SYSTEM; Samuel C. McKeown, East Orange, N. J. App. filed Sept. 9, 1918. Airplanes.

1,305,142. CIRCUIT INTERRUPTER; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed April 5, 1916. Prevents expulsion of insulating oil.

1,305,149. SYSTEM OF CONTROL; Hurd T. Morris, Wilkinsburg, Pa. App. filed Sept. 25, 1914. Automatic for accelerating commutator-type alternating-current motors.

1,305,153. BINDING POST FOR ELECTRIC CABLES; Edward B. Nowosielski, Broomfield, N. J. App. filed Nov. 29, 1918. Igniting apparatus.

1,305,158. SWITCH HANDLE; Clarence D. Platt, Bridgeport, Conn. App. filed April 27, 1918. Can be firmly fixed to the switch blades.



1,305,142—Circuit Interrupter

1,305,165. CIRCUIT BREAKER; William H. Ratcliff, Newark, N. J. App. filed Feb. 24, 1917. Primary circuit of a high-tension magneto.

1,305,167. ELECTRIC FURNACE; Ivar Rennerfelt, Djursholm, Sweden. App. filed Oct. 3, 1918. Centrally located vertical electrodes.

1,305,168. INSULATOR; Omer L. Roberts, Macy, Ind. App. filed July 21, 1916. Telegraph and telephone.

1,305,177. ELECTRIC HEATING AND MELTING FURNACE; Victor Stobie, Dunston-Upon-Tyne, England. App. filed March 28, 1918. Prevents electrode outside of furnace from oxidizing.

1,305,190. ALARM; Charles F. Bobo, Hollis, N. Y. App. filed Oct. 4, 1915. Electrical.

1,305,191. EXPRESSION-DEVICE CONTROL; James W. Bryce, Bloomfield, N. J. App. filed Dec. 22, 1916. Phonographs.